FISHERIES BIOLOGICAL ASSESSMENT AND EVALUATION

BULL TROUT (*Salvelinus confluentus*)
WESTSLOPE CUTTHROAT TROUT (*Oncorhynchus clarkii lewisi*)
WESTERN PEARLSHELL MUSSEL (*Margaritifera falcata*)

BITTERROOT NATIONAL FOREST
REGION 1, MONTANA

Project Name: Mud Creek
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Ranger District: West Fork
Date Prepared: March 19, 2021 (FINAL)

On June 10, 1998, the United States Fish and Wildlife Service (USFWS) listed bull trout as a threatened species within the Columbia River Basin (Federal Register 63 FR 31647, Vol. 63, No. 111, June 10, 1998). Section 7(a)(2) of the Endangered Species Act (ESA) of 1973 as amended, requires all Federal agencies to review actions authorized, funded, or carried out by them to ensure such actions do not jeopardize the continued existence of listed species. This biological assessment and evaluation (BA/BE) evaluates potential effects of the Proposed Federal Action on bull trout core areas and local populations within the Upper Columbia Recovery Unit (USFWS, 2015a). A core area represents the closest approximation of a biologically functioning unit for bull trout. Emphasis is placed on securing the existing distribution within core areas and increasing the abundance and connectivity of local populations (USFWS, 2015a). However, the determination of the effects of this project is based on the project's effects to individual bull trout.

The Bull Trout Recovery Plan delineates two core areas in the Bitterroot River drainage: (1) the Bitterroot River core area, which includes all areas downstream of Painted Rocks Dam; and (2) the West Fork Bitterroot River core area, which includes all areas upstream of Painted Rocks Dam (USFWS, 2015a: Map E, pg. 88). The Mud Creek project area includes portions of both core areas. Two bull trout local populations (Lower West Fork Bitterroot River and Nez Perce Fork) reside within the Bitterroot River core area portion of the project area; one bull trout local population (Blue Joint Creek) resides within the West Fork Bitterroot River core area portion of the project area.

The 2010 final rule for the designation of critical habitat for the Columbia River population of bull trout (USFWS, 2010: Federal Register 75FR 63898, Vol. 75, No. 200, October 18, 2010) designated critical habitat in three streams in the action area - the West Fork Bitterroot River, the Nez Perce Fork, and Blue Joint Creek. The West Fork Bitterroot River is designated as foraging, migratory, and overwintering (FMO) habitat; the Nez Perce Fork and Blue Joint Creek are designated as spawning and rearing (SR) habitat. Impacts to critical habitat are assessed in this BA/BE. Map 3 in this BA/BE displays the critical habitat in the action area.

A biological evaluation (BE) evaluating potential effects of this project on westslope cutthroat trout and western pearlshell mussels is incorporated within this document. The westslope cutthroat trout has been designated as a Sensitive species on the Bitterroot National Forest for many years. The western pearlshell mussel was designated as a Sensitive species on the Bitterroot National Forest in 2010.

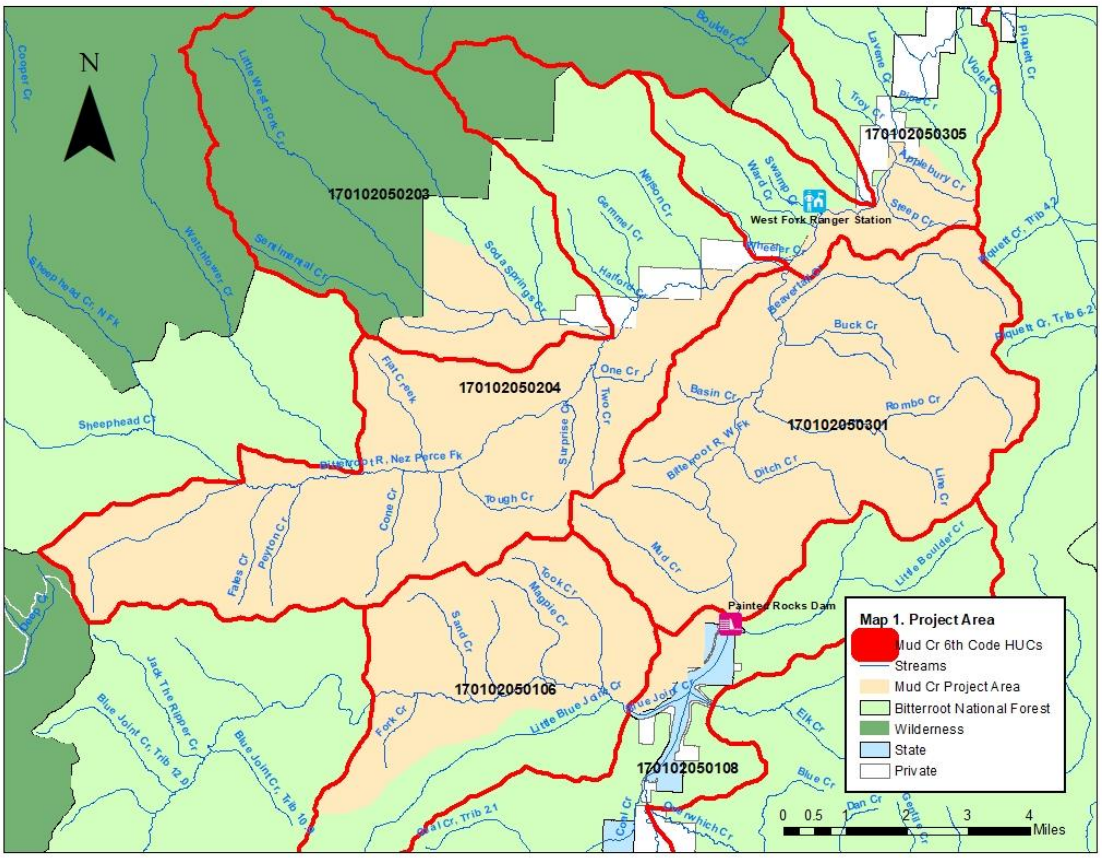
This BA/BE assisted the Bitterroot National Forest (Forest) in determining that the Proposed Federal Action in the Mud Creek Project is Likely to Adversely Affect (LAA) bull trout and bull trout critical habitat. This BA/BE is designed to satisfy the requirements of the Forest Service and USFWS, and describes the:

Appendices A, B, C, and D are attached to the back of this BA/BE. Appendix A is a site-specific Watershed Analysis. Appendix B lists the aquatic design features for the Mud Creek Project. Appendix C contains copies of Project File documents AQUATICS-003 (RHCA effectiveness white paper) and AQUATICS-005 (list of Bitterroot NF projects where design feature effectiveness was monitored). Appendix D contains a map of the RHCAs in the action area.

1. Project Location

The Mud Creek Project is located north and west of Painted Rocks Reservoir in Ravalli County, Montana. The project is located on the West Fork Ranger District of the Bitterroot National Forest. The project area is about 48,485 acres and includes portions of the West Fork Bitterroot River (6th level HUCs 170102050301, 0305, and 0108), Blue Joint Creek (HUC 0106), Little West Fork (HUC 0203), and Nez Perce Fork (HUC 0204) watersheds. Map 1 displays the project area and its surrounding vicinity.

Map 1. Project Area and Surrounding Vicinity



2. Action Area

The action area is defined as the geographic extent of potential effects on bull trout and bull trout critical habitat resulting from the Proposed Federal Action. For this project, the action area is the same as the project area. The action area consists of the following NRCS 6th level HUCs or portions of those HUCs:

- All of HUC 170102050106 except for the Little Blue Joint Creek drainage
- About 646 acres of HUC 170102050108 (2% of the HUC area) on the west side of Painted Rocks Reservoir between the dam and Blue Joint Creek
- About 2,253 acres of HUC 170102050203 (14% of the HUC area) which includes the lower ends of the Little West Fork, Soda Springs Creek, and Sentimental Creek drainages
- All of HUC 170102050204 except for the portions of the Nelson, Gemmell, and Halford Creek drainages north of Forest Road (FR) 468
- All of HUC 170102050301
- About 1,926 acres of HUC 170102050305 (9% of the HUC area) which includes 2.1 miles of the West Fork Bitterroot River and the Steep Creek and Applebury Creek drainages
- About 304 acres of HUC 170102050105 (1% of the HUC area) which consists of a small parcel of high elevation land near the Bare Cone lookout in the Upper Blue Joint Creek drainage
- About 62 acres of HUC 170102050202 (0.6% of the HUC area) which consists of the lower 0.3 miles of the Watchtower Creek drainage
- About 5 acres of HUC 170102050201 (0.04% of the HUC area) which consists of a tiny sliver of the Sheephead Creek drainage
- About 0.4 acres of HUC 170102050302 (0.003% of the HUC area) which consists of a tiny sliver of the Boulder Creek drainage
- About 0.1 acres of HUC 170102050303 (0.0005% of the HUC area) which consists of a tiny sliver of the Piquett Creek drainage

With the exception of 0.34 miles of road decommissioning in HUC 0202 (Watchtower Creek), no activities are proposed in HUCs 0105 (Upper Blue Joint Creek), 0201 (Sheephead Creek), 0302 (Boulder Creek), and 0303 (Piquett Creek) that would affect aquatic resources. Therefore, these HUCs are not analyzed in this BA/BE.

The Watchtower Creek drainage (HUC 0202) is listed in Tables 1 and 2 because of the 0.34 miles of road that is proposed for decommissioning. Beyond that, HUC 0202 is not analyzed in this BA/BE because there are no activities proposed in that HUC that would affect aquatic resources.

The following segments of bull trout critical habitat are located within the action area:

- The West Fork Bitterroot River (FMO) between Painted Rocks Dam and Boulder Creek
- All of the Nez Perce Fork (SR)
- Blue Joint Creek (SR) downstream from the Blue Joint Trailhead

The following areas are located upstream from the action area and are not included in the action area because no project activities or effects would occur in those areas:

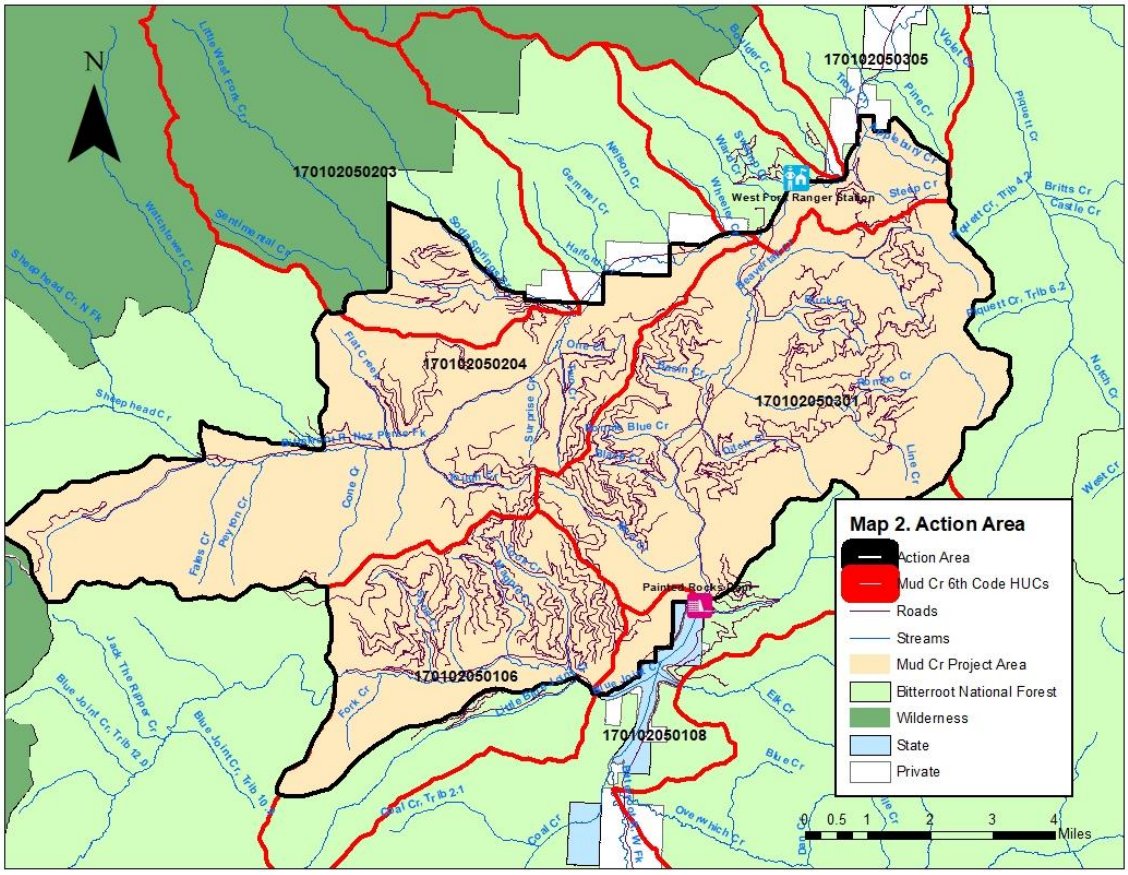
- The West Fork Bitterroot River drainage upstream of Blue Joint Creek, including the Little Boulder and Slate Creek drainages
- The Blue Joint Creek drainage upstream of the Blue Joint Trailhead
- The Little Blue Joint Creek drainage
- The Sheephead Creek drainage
- The portion of the Watchtower Creek drainage above the Watchtower Creek Trailhead
- The Little West Fork, Soda Springs, and Sentimental Creek drainages upstream of the project boundary
- The Nelson, Gemmell, and Halford Creek drainages north of FR 468

- The Boulder Creek drainage

The portion of the West Fork Bitterroot River downstream of Troy Creek and the Piquett Creek watershed (HUC 0303) are not included in the action area because they are located too far downstream to receive any meaningful effects from the activities in the Mud Creek Project.

The action area primarily consists of National Forest timber lands that are moderately to heavily roaded (Map 2). Road densities in the action area (all ownerships combined) range between 2.5 miles/mile^2 in HUC 0305 to 11.7 miles/mile^2 in HUC 0106 (Table 11). Most of the action area exceeds 4 miles/mile^2 (Table 11). There is not much private land in the action area. A string of small private parcels occurs along the West Fork Highway below Painted Rocks Dam and along the lower four miles of FR 468. These parcels border the West Fork Bitterroot River and the lower end of the Nez Perce Fork and contain homes in forested settings. The vast majority of the National Forest land in the action area is unburned. Map 2 displays the action area.

Map 2. Action Area



3. Project Description

This BA/BE analyzes the effects of the Proposed Action Alternative that is described in the Mud Creek Environmental Assessment. The Proposed Action Alternative will be referred to as the "Proposed Federal Action" in the remainder of this BA/BE.

The NEPA decision that will be signed for the Mud Creek Project may or may not contain all of the activities that are analyzed in this BA/BE. The NEPA decision could very well consist of a scaled back

version of the activities that are analyzed in this BA/BE; however, the decision will NOT include any activities that are not analyzed in this BA/BE.

The purpose of the Proposed Federal Action is to:

1. Improve landscape resilience to disturbances (such as insects, diseases, and fire) by modifying forest structure and composition, and fuels; and
2. Design and implement a suitable transportation system for long-term land management that is responsive to public interests and reduces adverse environmental effects.

The Proposed Federal Action consists of the following activities:

- Timber harvest
- Manual fuel reduction treatments (prescribed burning and non-commercial thinning)
- Road treatments (construction, reconditioning, reconstruction, decommissioning and storage)
- Motorized trail construction (linking together existing OHV roads to make loops)
- Herbicide application

Each of these activities is described below, along with the design features that apply to that activity. Appendix B contains a list of the aquatic design features.

Timber Harvest

Default RHCA widths (USDA Forest Service, 1995; pgs A-5 and A-6) would apply to all water bodies in the action area. The default RHCA width on intermittent streams would be 100 feet.

Timber harvest could occur anywhere in the action area as permitted by the Forest Plan (USDA Forest Service, 1987) as long as it complies with the following design features:

- *No timber harvest in RHCAs with the exception of three small areas that are referred to as areas 1, 2, and 3 in this BA/BE. The total acreage of the three areas is about 43 acres; the portions of those areas where limited timber harvest would occur within RHCAs is about 19 acres. Specific design features apply to each of these areas and are described below.*
- *No yarding of logs, entry of harvest equipment, or driving skidders in RHCAs.*
- *In general, log landings will be located outside of RHCAs. Exceptions may be granted for previously used landings or natural openings that are located within RHCAs. These sites will not be used for landings until field reviewed and approved by the fisheries biologist or hydrologist.*
- *Equivalent clearcut area (ECA) will not exceed 20% in any watersheds. This restriction applies to all of the individual sub-watersheds that are nested within 6th level HUCs.*

There are three areas where a limited amount of timber harvest would be allowed within the outer half of 300-foot wide RHCAs. The three areas are called "area 1", "area 2", and "area 3", and the specific design features that apply to each area are described below. The total amount of timber harvest acreage within RHCAs in the three areas is about 19 acres. Appendix A contains a site-specific Watershed Analysis that documents the rationale for allowing timber harvest in the RHCAs of areas 1, 2, and 3.

Area 1. Area 1 is an approximate nine-acre polygon bounded by Nelson Creek on the west, the Nez Perce Fork on the south and east, and FR 468 on the north. The following design features will apply to area 1:

- *No treatment will occur within 50 feet of Nelson Creek, the Nez Perce Fork, or any wetlands.*
- *Manual thinning of sub-merchantable trees, piling of slash, and pile burning can occur anywhere outside of the no treatment zones.*
- *Commercial harvest of live and dead trees will occur > 150 feet from Nelson Creek, and above the edge of the terrace surrounding the Nez Perce Fork. The edge of the terrace is mostly > 300 feet from the Nez Perce Fork. On the extreme east side of area 1, the edge of the terrace necks down to 200 feet from the Nez Perce Fork.*
- *Harvest (tractor yarding) will occur in winter when adequate winter ground conditions are present.*

- *Log landings will be located > 300 feet from Nelson Creek and the Nez Perce Fork.*

Area 2. Area 2 is an approximate six-acre polygon bounded by the Little West Fork on the northeast, FR 5635 on the southwest, and FR 468 on the southeast. The following design features will apply to area 2:

- *No treatment will occur within 150 feet of the south channel of the Little West Fork or within 50 feet of wetlands.*
- *Manual thinning of sub-merchantable trees, piling of slash, and pile burning can occur anywhere outside of the no treatment zones.*
- *Commercial harvest of live and dead trees will occur > 150 feet from the south channel of the Little West Fork.*
- *Harvest (tractor yarding) will occur in winter when adequate winter ground conditions are present.*
- *Log landings will be located either on or south/west of FR 5635 (i.e. the side of the road opposite the RHCA).*

Area 3. Area 3 is an approximate 28-acre polygon bounded by Applebury Creek on the north, the West Fork Bitterroot River on the west, the toe of the mountain slope on the east, and the private land boundary on the south. Applebury Creek crosses the northern tip of area 3; Steep Creek is well outside the area to the south. The following design features will apply to area 3:

- *No treatment will occur below the edge of the terrace that parallels the West Fork Bitterroot River. The edge of the terrace is about 50 feet from the ordinary high water mark of the river. No treatment will occur within 50 feet of Applebury Creek.*
- *Manual thinning of sub-merchantable trees, piling of slash, and pile burning can occur anywhere outside of the no treatment zones.*
- *Downed trees can be winched out of the following areas for firewood harvest: river = edge of terrace to 150 feet; Applebury Creek = 50 to 100 feet. The vehicles doing the winching must stay > 150 feet from the river and > 100 feet from Applebury Creek.*
- *Commercial harvest of live or dead trees will occur > 150 feet from the river and > 100 feet from Applebury Creek.*
- *If tractor yarding is utilized, it must occur in winter when adequate winter ground conditions are present. If pick-up trucks with winch cables are used, there are no restrictions on season of harvest.*
- *Log landings will be located > 300 feet from the river.*
- *No equipment (tractor skidders or pick-up trucks) will enter within 150 feet of the river or within 100 feet of Applebury Creek.*

The dominant vegetation type in the action area is dry ponderosa pine and Douglas fir. The timber harvest prescriptions in the Proposed Federal Action would include a combination of regeneration treatments, intermediate treatments, and non-commercial treatments. The objective of the treatments is to improve landscape resilience to disturbances (such as insects, diseases, and fire) by modifying forest structure and composition, and fuels. Yarding methods for the commercial treatments would consist of a mix of tractor and skyline yarding systems. Harvest could occur during any season as long as the design features for soils are being met. The range of acres that could be treated in each category would be:

- Commercial Regeneration Treatments: 1,200 to 4,800 acres
- Commercial or Mechanical Intermediate Treatments: 4,100 to 8,900 acres
- Non-commercial Treatments: 3,000 to 10,000 acres

Commercial regeneration treatments for even-aged stands could include seed tree cuts, shelterwood cuts, and clearcuts with reserves. Seed tree and shelterwood cuts would primarily occur within Douglas-fir dominated or mixed conifer stands where stands contain high tree density, an undesirable species composition for the site, have insects or disease present, or are at moderate to high hazard for insect related mortality. The establishment of a new age-class of trees would be the desired condition. Clearcuts with reserves would be considered for lodgepole pine dominated stands or Douglas-fir stands experiencing

heavy amounts of disease. These stands have reached culmination in growth and will never be able to reach the desired stand conditions. Establishment of a new age-class of trees would be the desired condition.

Several of the regeneration harvest treatment areas could create forest openings that exceed 40 acres in size due to existing conditions (i.e. insects and disease). These larger openings could range in size from 41 to about 200 acres, mimicking natural disturbance patterns using seed tree, shelterwood or clearcut silvicultural methods. Varying densities of trees would be retained within these areas, from scattered individuals to groups consisting of the largest, healthiest trees. Compared to intermediate harvest areas and untreated forests, regenerated areas would appear as openings until new trees grow to fill the site.

Commercial regeneration treatments for even-aged stands could include group selection and individual tree selection cuts. Group selection and individual tree selection cuts would primarily occur in warm and dry forest types. These treatments would retain the large legacy ponderosa pine scattered throughout the action area, thinning pockets with higher stand density and creating scattered openings to allow a new age-class to become established. The objective would be to promote an irregular, patchy multi-aged ponderosa pine stand.

Commercial intermediate treatments could include improvement cuts and commercial thins. Improvement cuts and commercial thins would primarily occur in warm, dry forest types where generally desirable stands are present but in need of thinning to reduce stand densities, improve species composition, and lower the risk of insects, disease and fire. Improvement cuts may be considered within old growth stands to increase resilience and carry the old growth stand into the future. Commercial thins may occur in mature terraced plantations where feasibility and soil conditions favor treatment.

Regardless of the type of harvest that is prescribed, the important note to emphasize for aquatic resources is that ECAs will not exceed 20% in any watersheds. This restriction applies to all of the individual sub-watersheds that are nested within the larger 6th level HUCs.

The action area contains 79 terraced plantations ranging in size from one acre to 130 acres, and totaling about 1,645 acres. The majority of the terraces were planted with ponderosa pine in the 1960's and 1970's. Stand health, tree size, density and soil conditions varies greatly across the terraces. Vegetation treatments in terraces would be site dependent and may range from commercial thinning, non-commercial hand thinning, prescribed burning, pile burning, mastication, or a combination thereof or no treatment. The objective is to manage for soil recovery, and increase stand resiliency to insects, disease and fire.

The commercial harvest treatments in the Proposed Federal Action could produce as many as 13,500 log truck loads. This number is likely an over-estimate; however, it was intentionally estimated high to ensure that worst-case scenario effects are analyzed. Regardless of the number of truck loads, all hauling must comply with the following design features:

- *Roads used for log hauling will be brought up to current BMP standards prior to hauling. Potential BMP treatments include graveling stream crossings and road segments within 100 feet of streams, constructing driveable dips into the travelway to reduce flowpath lengths to 200 feet or less, installing slash filter windrows in sediment contributing areas, and lining ditches and catch basins with rock where needed.*
- *All of the stream crossings (n = 7) in the Rombo Creek drainage portions of FR 5715 and FR 13446 will be graveled with bentonite aggregate. This will occur in addition to the normal suite of BMP upgrades.*
- *Hauling will occur when roads are either adequately frozen or dry. Hauling will cease during periods that are wet enough to produce movement of fines on the road surface*.
- *All maintenance activities (e.g. road grading, snow plowing, etc) associated with haul roads will follow the minimization measures for each road activity type specified in the April 2015 Programmatic Biological Opinion for Road-Related Activities (USFWS, 2015b).*
- *A maximum of 2,000 log truck loads will be hauled on Blue Joint Creek FR 362. A maximum of 2,000 log truck loads will be hauled on Nez Perce FR 468. A maximum of 500 log truck loads will be hauled in the Rombo Creek drainage on FR 5715 between the Buck Creek Saddle and the*

junction of FR 13446 to FR 5715. A truck load is defined as one log truck driving into the landing empty, and then driving back out loaded with logs and headed to the mill.

- *If any of the following near-stream haul roads are used for winter hauling (Blue Joint Creek FR 362; Nez Perce FR 468; Two Creek FR 732; Flat Creek FR 5637; and Tough Creek FR 5644): sediment traps will be installed (1) below the outlets of ditch relief culverts within 100 feet of streams; (2) at stream crossings; and (3) in road ditches that drain into streams. The sediment traps will be installed prior to winter hauling and maintained during all periods of winter hauling. The sediment traps may consist of straw bales, straw waddles, fiber logs, slash filter windrows, and/or some combination of all of these.*
- *Prior to hauling any logs, the native surface portions of the near-stream segments of Two Creek FR 732, Tough Creek FR 5644, and Flat Creek FR 5637 will be graveled. Portions of FRs 732 and 5644 are already graveled. If the current condition of the gravel surface and the BMP upgrades is deemed to be adequate by Forest engineers and hydrologists, then the previously graveled portions do not need to be re-graveled before hauling logs.*
- *On reconditioned or reconstructed haul roads, the grading that occurs at stream crossings will (1) leave as much of the existing vegetation on the travelway as possible; (2) avoid sidecasting road material within RHCAs (sidecasting is prohibited in RHCAs); and (3) install driveable dips on the uphill approach within 100-200 feet of the stream crossings to divert water and sediment from the travelway prior to the road entering the stream crossing area. The exact location of the dips will depend on individual site conditions such as road slope, presence of ditch in the road design, rock outcrops, and channel location. Addition of gravel at stream crossings will depend on site conditions and consultation with engineering, fisheries or hydrology.*
- *Where existing water bars are bladed out during maintenance or reconditioning, water bars will be installed when completing final maintenance or closing the road. Follow the waterbar spacing guide in Appendix B.*

In this BA/BE, any road segments that parallel within 100 feet of streams are referred to as "near-stream road segments". Additional information on log hauling is provided in Section 5.2.1.3 of this BA/BE.

Manual Fuel Reduction Treatments

Manual fuel reduction treatments consist of prescribed burning and manual thinning, piling, and pile burning of sub-merchantable trees. These activities could occur anywhere in the action area as long as they comply with the following design features:

- *No helicopter ignition in RHCAs.*
- *Hand ignition is allowed in RHCAs but will not occur within 50 feet of streams and wetlands. Fire will be allowed to back into and burn across the RHCAs if it so desires.*
- *Hand line is not prohibited in RHCAs, but fire managers should minimize its use in RHCAs as much as possible. Hand lines in RHCAs must avoid wetlands and be recontoured and covered with slash after use.*
- *No machine fireline in RHCAs.*
- *No manual thinning or slash piling within 50 feet of streams and wetlands.*
- *If drafting from streams occurs, intake hoses will be fitted with a screen mesh equal to or smaller than 3/32 inch.*

These design features are consistent with the mitigation measures in the U.S. Fish and Wildlife Service's programmatic biological assessments for prescribed fire (USFWS, 2001) and timber stand improvement (USFWS, 1999).

The majority of the prescribing burning that occurs in the action area is expected to occur in the springtime when RHCAs tend to be cool, moist, and less prone to burn. Fall burning may also occur, but it is unlikely

to be as used as frequently as spring burning because it is more difficult to attain proper burning conditions. The range of acres that could be treated with prescribed fire would be:

- Prescribed Fire for Site Preparation: 4,000 acres
- Low Severity Prescribed Fire: 28,235 acres
- Mixed Severity Prescribed Fire: 11,085 acres

Manual vegetation treatments could include thinning/slashing, masticating, and/or chipping sub-merchantable trees, planting trees and native plants, whitebark pine daylighting, reducing conifer encroachment in meadows, and aspen restoration. Treatment techniques for aspen restoration may include removal and hand piling and/or burning of small conifers; girdling larger competing conifers; low intensity prescribed fire; and fencing. All of the manual vegetation treatments would follow the mitigation measures in the programmatic biological assessment for timber stand improvement (USFWS, 1999).

Road Treatments

Road treatments consist of building new specified roads, building and obliterating temporary roads, reconditioning and/or reconstructing existing roads, and decommissioning or storing existing roads. The road treatments in the Proposed Federal Action are summarized by 6th level HUC in Table 1.

Table 1. Proposed Road Treatments in the Action Area

6th HUC	**Miles of new specified road construction**	**Miles of temporary road construction**	**Miles of potential road reconditioning or reconstruction within 100 feet of NHD streams** \1	**Miles of decommission**	**Miles of storage**
0106 (Lower Blue Joint)	0	3.35	2.0 (53 crossings)	18.42	0.4
0108 (Painted Rocks Lake-WF Bitt River)	0	0.40	0.04 (1 crossing)	0.75	0
0202 (Watchtower Creek)	0	0	0 (0 crossings)	0.34	0
0203 (Little West Fork)	0.88	4.47	0.2 (6 crossings)	1.82	1.12
0204 (Nez Perce Fork)	3.97	9.84	0.7 (18 crossings)	7.21	8.02
0301 (Rombo Cr-WF Bitt River)	4.91	12.40	2.1 (56 crossings)	12.54	6.64
0305 (Lloyd Cr-WF Bitt River)	0	2.15	0.2 (4 crossings)	0.13	0
TOTALS	9.76	32.79	5.24 (138 crossings)	41.21 \2	16.39 \3

\1 A subset of these road stream crossings would be reconditioned or reconstructed in the Proposed Federal Action. The exact number of crossings that would require reconditioning or reconstruction is undetermined at this time.

\2 21.01 miles of the 41.21 miles would be maintained as motorized trail after the decommissioning occurs.

\3 0.90 miles of the 16.39 miles consists of non-system roads that would be added to the Forest's road system and then placed in long-term storage.

Table 2 shows how the road metrics in the action area would change as a result of the Proposed Federal Action. The desired outcome for aquatic resources would be a negative number in each cell.

Table 2. Change in Road Metrics in the Action Area Resulting from the Proposed Federal Action

6th HUC	**Baseline Condition for "Road Density & Location" Indicator**	**Miles of road in the action area /1**	**Miles of road within RHCAs in the action area /2**	**Number of road stream crossings in the action area /3**
0106 (Lower Blue Joint)	FUR	- 18.48	- 6.34	- 16
0108 (Painted Rocks Lake-WF Bitt River)	FAR	- 0.75	- 0.10 /4	- 1 /4
0203 (Little West Fork)	FAR	- 0.94	- 0.03	- 3
0204 (Nez Perce Fork)	FUR	- 4.54	- 2.42	- 4
0301 (Rombo Cr-WF Bitt River)	FUR	- 7.17	- 4.58	- 11
0305 (Lloyd Cr-WF Bitt River)	FUR	- 0.13	No change /5	No change /5
TOTALS		- 32.01	- 13.47	- 35

\1 Calculated by taking the existing condition, adding the miles of new specified road construction in Table 1 and any additions of non-system roads, and then subtracting the miles of road that would be decommissioned in Table 1.

\2 Calculated by taking the existing condition, adding the miles of new specified road that would be constructed in RHCAs, and then subtracting the miles of road that would be decommissioned in RHCAs

\3 Calculated by taking the existing condition, adding the number of new stream crossings on specified roads, and then subtracting the number of stream crossings that would be eliminated by road decommissioning and storage treatments.

\4 In HUC 0108, FR 13809 would be decommissioned, and the portion of the road where one stream crossing would be removed is located a short distance outside of the action area.

\5 Only a small portion of HUC 0305 is located in the action area, and the only roads within RHCAs are the West Fork Highway and private roads which the Forest Service has no authority to change.

FUR = Functioning at Unacceptable Risk. FAR = Functioning at Risk.

A maximum of 9.76 miles of new specified roads are proposed for construction in the Proposed Federal Action (Table 1). The specified roads would be built to modern BMP standards. All of the specified roads would be managed as maintenance level 1 roads and only be open to administrative use during and after project implementation. A barrier would restrict public entry on all new specified roads. The specified roads would mostly avoid RHCAs. In HUC 0301, approximately 0.25 miles of specified road would be constructed within RHCAs, with four new crossings on small, non-fish bearing, intermittent and small perennial streams. None of this RHCA construction would occur in bull trout watersheds, nor would it cross or encroach upon fish-bearing streams. In the rest of the action area, construction of specified roads would occur outside of RHCAs, including the bull trout priority watersheds of Lower Blue Joint Creek (HUC 0106), Little West Fork (HUC 0203), and Nez Perce Fork (HUC 0204).

A maximum of 32.79 miles of temporary roads (the mileage includes tracked line machine trails) are proposed for construction in the Proposed Federal Action (Table 1). All of the temporary roads that would be built in the Proposed Federal Action would be located outside of RHCAs. In a few instances where road prisms already exist in RHCAs (e.g. undetermined roads), and there are culverts at the stream crossings, those prisms could be used as temporary roads as long as dirt is not side-casted within the RHCA. Temporary roads and tracked line machine (TLM) trails are generally constructed near ridgelines and upper slopes and usually do not come close to RHCAs. Temporary roads are likely to be present on the landscape for 1-3 years before they are recontoured and seeded. The ground-disturbing footprint of TLM trails is similar to that of temporary roads, but TLM trails are usually present on the landscape for a shorter period of time (a few months) before being recontoured and seeded.

Some of the maintenance level 1 and 2 roads in the action area would require reconditioning and/or reconstruction before they could be used for timber sale access and/or log haul in the Proposed Federal

Action. These roads are generally closed to full-size vehicles and have various levels of vegetation growing on their driving surfaces. Reconditioning and/or reconstruction involves clearing vegetation and obstacles (rocks, wood) from the driving surfaces so that the roads can be driven on by logging equipment and log trucks. The driving surfaces of reconditioned or reconstructed roads are typically scraped to mostly bare ground by a dozer or grader, and soil is usually sidecast down the fillslope.

Road reconstruction and/or reconditioning could potentially occur on any maintenance level 1 or 2 roads in the action area that are currently impassible due to vegetation or obstacles. There are about 346 miles of maintenance level 1 and 2 roads in the action area, with 138 stream crossings (Table 1). An unknown amount of the 346 miles is currently driveable and would not need treatment to use for timber harvest and log truck access.

The maintenance level 1 and 2 roads in the action area are typically upland spur roads that cross 1st and 2nd order headwater tributaries while contouring across middle to upper slopes. The density of stream crossings on the maintenance level 1 and 2 roads averages one crossing for every 2.5 miles of road. About half of the crossings are on intermittent streams; the other half on small, non-fish bearing perennial streams. The maintenance level 1 and 2 roads typically cross streams at perpendicular angles and do not parallel within 100 feet of streams for significant lengths.

Road reconstruction and/or reconditioning activities must adhere to the following design features:

- *On reconditioned or reconstructed roads, the grading that occurs at stream crossings will: (1) leave as much of the existing vegetation on the travelway as possible; (2) avoid sidecasting road material within RHCAs (sidecasting is prohibited in RHCAs); and (3) install driveable dips on the uphill approach within 100-200 feet of the stream crossings to divert water and sediment from the travelway prior to the road entering the stream crossing area. The exact location of the dips will depend on individual site conditions such as road slope, presence of ditch in the road design, rock outcrops, and channel location.*
- *Stream crossings may or may not be graveled. The addition of surface rock on maintenance level 1 and 2 roads at stream crossings will be dependent upon site conditions and consultation with engineering, fisheries or hydrology.*
- *Road maintenance activities will follow the minimization measures for each road activity type specified in the April, 2015 Road-Related Activities Biological Opinion (USFWS, 2015b).*
- *There will be no side-casting of soils in RHCAs.*

41.21 miles of system and undetermined roads are proposed for decommissioning and 16.39 miles are proposed to be placed in long-term storage in the Proposed Federal Action (Table 1). Of the 41.21 miles proposed for decommissioning, 21.01 miles would be converted to motorized trail (50-inch tread width) following decommissioning. Culverts would be removed and replaced with hardened fords. Potential treatments on the decommissioned road segments would range from full recontour of the road prism (the maximum ground disturbance treatment) to only blocking off the entrances of the roads and leaving the rest of the road prism intact (the minimum ground disturbance treatment). Roads placed into long-term storage would receive a similar range of treatments, with the main difference being more of the road length is decompacted and less is recontoured. On both decommissioned and stored roads, culverts would be removed at the stream crossings and the crossing area would be recontoured.

Road decommissioning and storage must adhere to the following design features:

- *Recontoured and decompacted roads and trails will be seeded, fertilized, and slashed. Weed-free straw mulch is required on sites located within 300 feet of streams.*
- *Where culverts with flowing water are removed, a straw bale check dam will be installed below the outlet prior to removing the culvert.*

Motorized Trail Construction

The Proposed Federal Action proposes to construct about three miles of new motorized trail in the action area. Most of the new trails would be 50-inch tread (ATVs); a lesser amount would be 72-inch tread (UTVs). The trail segments would connect existing roads to give motorized users more loop riding

opportunities. The trails would be located predominantly on ridges. They would avoid RHCAs and other areas where sediment could potentially be delivered to stream channels, wetlands or other water features.

Herbicide Application

The Proposed Federal Action includes the option of spraying herbicides on areas of ground disturbance created by project activities. This would be a "targeted" application – not a broadcast application. Areas specifically targeted would be temporary roads, recontoured roads and/or trails, landings, skid trails, and areas around rare plant populations that are being threatened by weeds. Application would occur by ground-based methods (backpack sprayers and/or vehicle-mounted sprayers), and no herbicides would be applied in RHCAs. Aerial application is prohibited. Herbicides could only be applied when ALL of the design features have been met:

Herbicide applications must adhere to the following design features:

- *Prior to any applications, aquatic specialists will complete and document toxicity calculations that show that the active ingredient applied will be of a LOWER CONCENTRATION than the 96-hour LC_{50} value divided by 25 ($LC_{50}/25$) found in the literature for either rainbow trout or cutthroat trout, whichever is lowest. The $LC_{50}/25$ is known as the "maximum acceptable toxicant concentration (MATC)". Toxicity will be calculated at the subwatershed scale (e.g. Beavertail Creek, Ditch Creek, Tough Creek, etc), NOT the HUC 12 scale.*
- *Herbicides will not be applied in RHCAs.*
- *Only ground-based methods (backpack sprayers and/or vehicle-mounted sprayers) will be used to apply herbicides.*
- *Herbicides will be applied according to label directions.*

4. Existing Conditions and Environmental Baseline

4.1 Data Collection

The information presented in this section of the BA/BE was obtained with the following methods:

- The distribution and abundance of bull trout and westslope cutthroat trout populations in the action area was determined by single-pass presence/absence electrofishing surveys (all potential fish-bearing streams), mark-recapture population estimates (Blue Joint Creek, Nez Perce Fork, Little West Fork, and Soda Springs Creek), and eDNA analysis (Soda Springs Creek). Details of the surveys are listed in the Forest's Presence/Absence Database. A copy of the database (electronic or hard copy format) is available upon request from the Bitterroot NF Supervisor's Office. Confidence in the fish population/distribution data is high because most of the presence/absence sites in the action area have been sampled at least three times over the past 25 years, and nearly all of the sites were re-sampled in 2018 or 2019. The mark-recapture population estimate data, in particular, is the most statistically rigorous and reliable fish population data that we possess on the Bitterroot NF.
- Habitat and INFISH Riparian Management Objective existing condition data was collected using I-walk habitat inventories. The I-walk inventory is a walk-through type habitat survey used on the Bitterroot NF to collect baseline habitat data at the reach scale. All of the fish-bearing streams in the action area were surveyed with I-walks in 2019 with the exception of Fork Creek, which was surveyed in 2020. In Took Creek, both I-walk and PACFISH/INFISH (PIBO) habitat surveys (USDA Forest Service, 2012; 2020) occurred in 2019. Took Creek is the only stream in the action area that contains a PIBO effectiveness monitoring reach. The PIBO reach in Took Creek (site #265) was surveyed in 2004, 2009, and 2019. PIBO data is the best tool that we possess for monitoring habitat changes over time. The I-walk inventory is useful for providing a "snap shot in time" of existing conditions, but is not precise enough to be used for long-term monitoring.
- Temperature data was collected in nearly all of the fish-bearing streams in the action area in 2018-19 using continuously recording HOBO model thermographs. Temperature data is not available for Sand and Fork creeks (both tributaries to Blue Joint Creek). The thermograph in Sand Creek

malfunctioned in 2018 and was lost or stolen in 2019. Temperatures in Fork Creek were not monitored. The larger streams such as the West Fork Bitterroot River, Blue Joint Creek, and the Nez Perce Fork have had their temperatures monitored every summer (or nearly every summer) since 1994. Our confidence in the thermograph data is high. The thermographs are precise measuring devices, and most of the streams in the action area have been monitored numerous times over the past 25 years.

- Sediment data was collected in 2019 in all of the fish-bearing streams except for Fork Creek, which was surveyed for sediment in 2020. Sediment was measured using the PIBO methodology described in USDA Forest Service (2016). Confidence in the sediment data is moderate. A large number of samples were collected to reduce bias to the degree possible, but some variability and observer bias is always going to be inherent with sediment measurements.

4.2 Bull Trout Populations

Bull trout numbers continue to decline in much of their range in the western United States, including many core area populations in western Montana. The two greatest threats to their continued existence are curtailment and degradation of their habitat, and competition with introduced species (USFWS, 2008). Bull trout core area populations in western Montana continue to decline. The most recent bull trout five year status review (USFWS, 2008) supported maintaining the bull trout listing as threatened throughout its range noting that with few exceptions, core area populations are not increasing and threats have not been removed. Recent re-surveys of mid 1990's bull trout sites in the neighboring East Fork Bitterroot River drainage indicate that over the past 20 years, site extirpations exceeded site colonization's and were more frequent at warm, low elevation sites (Eby et al. 2014). This pattern is also likely occurring at the lower elevations in the West Fork Bitterroot River drainage.

The action area overlaps portions of both the Bitterroot River and West Fork Bitterroot River core areas.

In the Bitterroot River core area, migratory forms of bull trout have declined to very low numbers. Monitoring indices for this core area are inadequate to discern trends due to the sparse fluvial and fragmented resident populations. Fewer fish are captured with similar effort than in previous decades. Nearly all of the bull trout that remain in the Bitterroot River core area consist of isolated resident populations. The Bitterroot River core area is discussed on pages 222-297 of the Bull Trout Conservation Strategy (USDA Forest Service, 2013).

In the West Fork Bitterroot River core area, bull trout consist of fish that were cut off from the rest of the Bitterroot River drainage when Painted Rocks Dam was constructed in 1938-40. A small adfluvial population of bull trout has developed in Painted Rocks Reservoir since construction of the dam, and the rest of the core area contains a mix of resident and juvenile migratory forms of bull trout. Sporadic abundance monitoring has occurred in the upper West Fork Bitterroot River and its tributaries, but trends are inconclusive. The larger streams all contain low numbers of bull trout, but typically the numbers are not adequate to calculate statistically valid estimates. Based on anecdotal reports, a mixture of migratory and resident bull trout are spread amongst multiple local populations, with numbers exceeding 100 adult fish and possibly as high as several hundred in the West Fork and its larger tributaries. Overall, densities are likely much reduced from historic levels, but distributions are probably similar to historic patterns. The West Fork Bitterroot River core area is discussed on pages 195-221 of the Bull Trout Conservation Strategy (USDA Forest Service, 2013).

Two bull trout local populations (Lower West Fork Bitterroot River and Nez Perce Fork) reside within the Bitterroot River core area portion of the Mud Creek action area; one bull trout local population (Blue Joint Creek) resides within the West Fork Bitterroot River core area portion of the action area. Critical habitat has been designated in three streams in the action area - the West Fork Bitterroot River below Painted Rocks Dam (FMO critical habitat), and the Nez Perce Fork and Blue Joint Creek (SR critical habitat).

The only bull trout population in the action area that is not recognized as an "official" local population by the U.S. Fish and Wildlife Service is a small, isolated population in the middle reaches of Rombo Creek. Prior to 2018, bull trout had not been documented in Rombo Creek. However, in 2018 a few juvenile bull

trout and bull trout X brook trout (*Salvelinus fontinalis*) hybrids were found in the half mile long portion of Rombo Creek between Line Creek and the FR 13462 road crossing. A few bull trout were thought to possibly reside above the FR 13462 crossing, but none were found in electrofishing surveys and a 2020 environmental DNA (eDNA) sample failed to detect bull trout above the road crossing. The FR 13462 culvert is thought to be a year-round barrier to upstream fish movement. The downstream extent of the bull trout distribution is undetermined, but it could possibly extend as far downstream as the Forest boundary. To the best of our knowledge, the Rombo Creek bull trout population is isolated to about 2.5 miles of occupied habitat in the middle portion of Rombo Creek between the Forest boundary and the FR 13462 crossing. The total size of the population probably does not exceed 200 individuals, and the population is likely composed of resident life history fish. There does not appear to be a fish passable connection between Rombo Creek and the West Fork Bitterroot River. The culvert under the West Fork Highway looks like a complete barrier to upstream fish movement, and Rombo Creek flows into a private pond and a beaver pond swamp before it can enter the West Fork Bitterroot River. The multiple channels that exit the pond and swamp and eventually make it into the West Fork do not appear to be fish passable, at least at low and moderate flows.

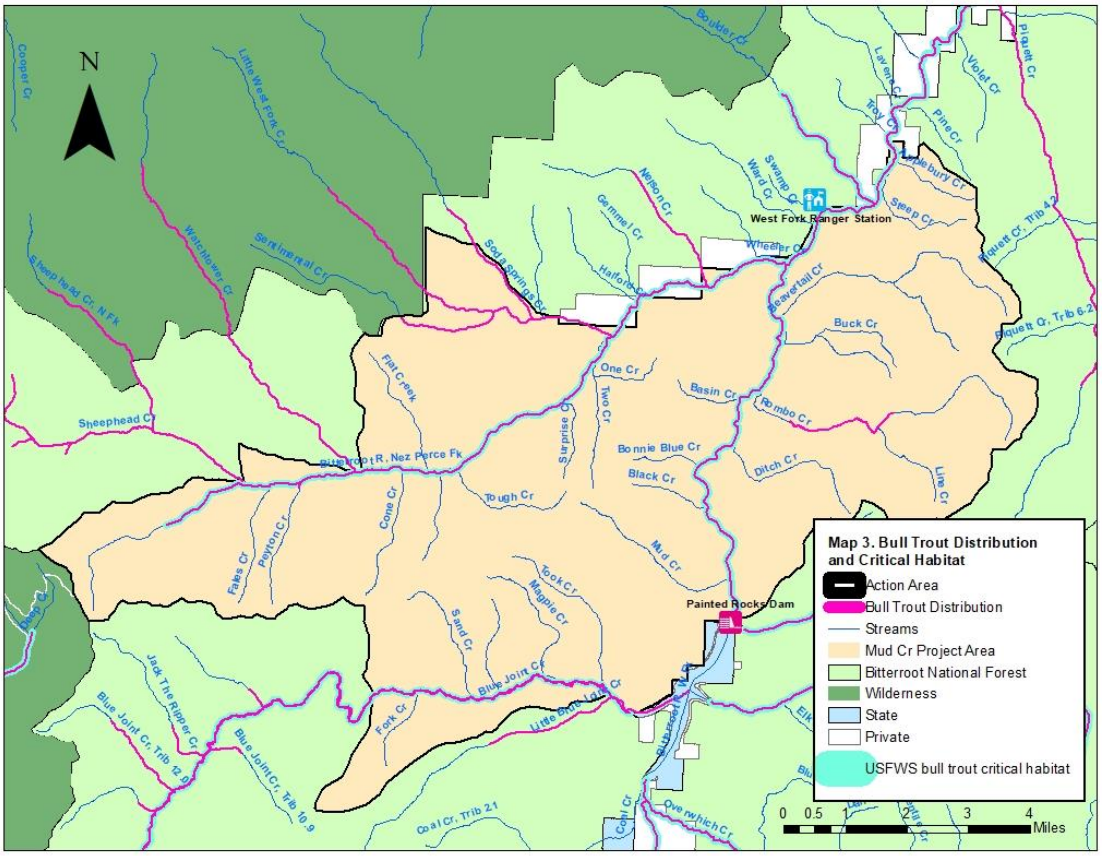
There are eight streams in the action area that contain bull trout. Table 3 lists those streams and the local population they belong to.

Table 3. Streams Containing Bull Trout in the Action Area

Stream	**Local Population**
West Fork Bitterroot River	Lower West Fork Bitterroot River
Nez Perce Fork	Nez Perce Fork
Little West Fork	Nez Perce Fork
Soda Springs Creek	Nez Perce Fork
Sentimental Creek	Nez Perce Fork
Nelson Creek	Nez Perce Fork
Blue Joint Creek	Blue Joint Creek
Rombo Creek	None, small isolated resident population

Map 3 displays the occupied bull trout habitat and bull trout critical habitat in the action area.

Map 3. Occupied Bull Trout Habitat and Designated Critical Habitat in the Action Area



Brook trout, a non-native competitor, are sympatric with bull trout throughout most of the action area, and a few bull X brook hybrids have been found in all of the bull trout streams listed in Table 3. In some areas, such as the Little West Fork watershed (HUC 0203), bull trout still outnumber brook trout by a small margin, but in others such as the Nez Perce Fork (HUC 0204), brook trout greatly outnumber bull trout and have largely replaced the species. Both species are present in the action area portion of the West Fork Bitterroot River, but neither is common.

Fish populations are periodically monitored in seven long-term Forest Plan monitoring reaches in the action area. These monitoring reaches are located at:

1. Nez Perce Fork, river mile (RM) 1.2
2. Nez Perce Fork, RM 9.8
3. Nez Perce Fork, RM 11.8
4. Little West Fork, RM 1.3
5. Little West Fork, RM3.1
6. Soda Springs Creek, RM 0.3
7. Blue Joint Creek, RM 5.9

Bull trout are present at low densities in each of these monitoring reaches.

The Nez Perce Fork drainage is the only major spawning area for bull trout in the West Fork Bitterroot River drainage below Painted Rocks Dam. The Nez Perce Fork (HUC 0204) is the arterial stream in the Nez Perce drainage. It provides about 12.4 miles of spawning and rearing habitat, and its larger tributaries (Nelson, Little West Fork, Watchtower, and Sheephead creeks) provide an additional 25 or so miles. The

Nez Perce Fork local bull trout population may contain more than 1,000 adult resident bull trout, but fewer than 50 migratory adults (USDA Forest Service, 2013: pg 247).

Most of the bull trout in the local population reside in the larger tributaries to the Nez Perce Fork, not in the Nez Perce Fork itself. Low numbers of bull trout are present the Nez Perce Fork where they are heavily outnumbered by brook trout (Figures 2 and 3). Bull trout X brook trout hybrids are also present at low numbers (Figures 2 and 3). Brown trout (*Salmo trutta*) currently occur at low numbers (Figures 1 and 2), but are a threat to increase their numbers and distribution in future years.

Figures 1, 2, and 3 display the numbers of bull trout, brook trout, bull trout X brook trout hybrids, and brown trout captured in the Nez Perce Fork at RM 1.2, RM 9.8, and RM 11.8 during mark/recapture electrofishing surveys. The data indicates that bull trout numbers have remained low in all of the reaches while brook trout numbers have increased at RM 11.8.

Figure 1. Number of bull, brook, and brown trout captured in 1000 feet of the Nez Perce Fork at RM 1.2.

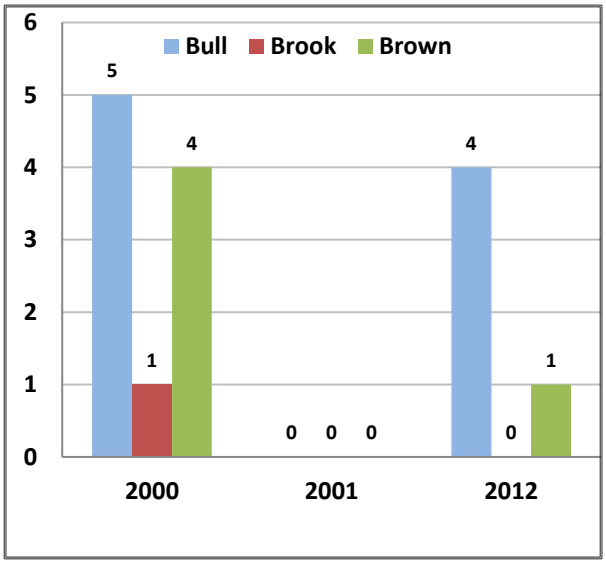


Figure 2. Number of bull trout, brook trout, brown trout, and bull X brook hybrids captured in 1000 feet of the Nez Perce Fork at RM 9.8.

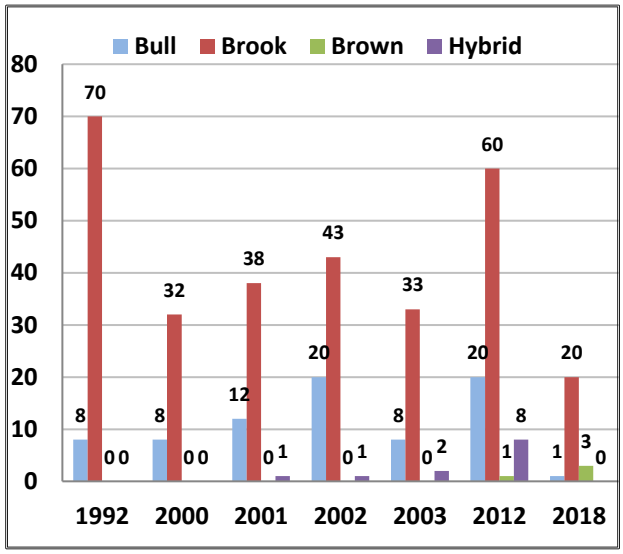
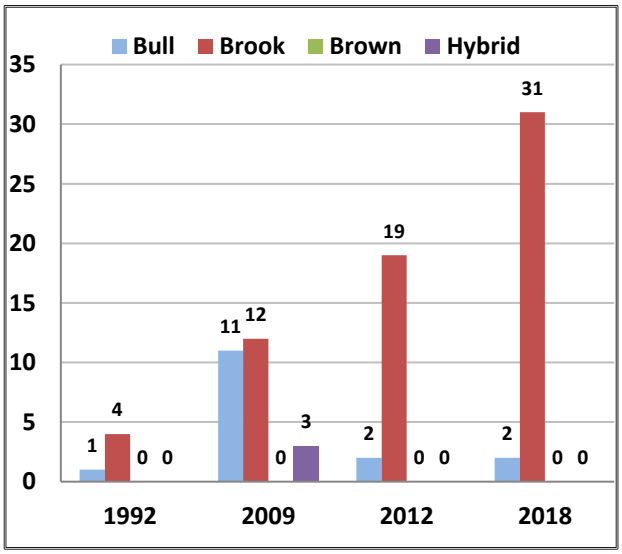


Figure 3. Number of bull trout, brook trout, brown trout, and bull X brook hybrids captured in 1000 feet of the Nez Perce Fork at RM 11.8.



The Little West Fork drainage (HUC 0203) is a tributary drainage to the Nez Perce Fork. The Little West Fork is the arterial stream in HUC 0203, and its two largest tributaries are Soda Springs and Sentimental creeks. All three streams provide spawning and rearing habitat for bull trout, totaling about 8 miles. The bull trout in the Little West Fork drainage are part of the Nez Perce Fork local population. Bull trout are more common in the upper half of the Little West Fork above Soda Springs Creek, and less common below. Below Soda Springs Creek, overlap and competition with brook and brown trout suppresses the local population. Monitoring surveys indicate that brook trout have not significantly expanded their upstream distribution in HUC 0203 since the early 1990's, but recently, brown trout may be increasing in number and distribution in the lower reaches of the HUC.

There are three long-term fish population monitoring reaches in HUC 0203. Two are in the Little West Fork at RM 1.3 (Figure 4) and RM 3.1 (Figure 5); the third is in Soda Springs Creek at RM 0.3 (Figure 6). Figures 4, 5, and 6 display the numbers of bull trout, brook trout, bull trout X brook trout hybrids, and brown trout captured in the monitoring reaches during mark/recapture electrofishing surveys. The data does not show conclusive trends. Bull trout and brook trout numbers have remained relatively low in HUC 0203 since monitoring began in the early 1990's. Brown trout are slowly increasing in the Little West Fork at RM 1.3 (Figure 4).

Figure 4. Number of bull trout, brook trout, brown trout, and bull X brook hybrids captured in 1000 feet of the Little West Fork at RM 1.3.

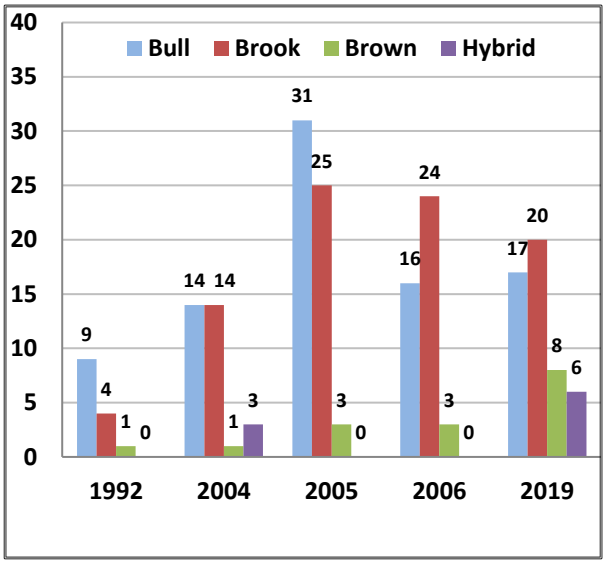


Figure 5. Number of bull trout, brook trout, brown trout, and bull X brook hybrids captured in 600 feet of the Little West Fork at RM 3.1.

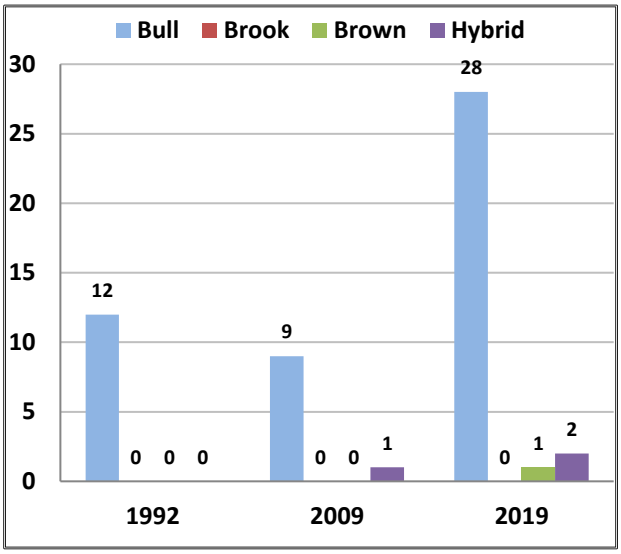
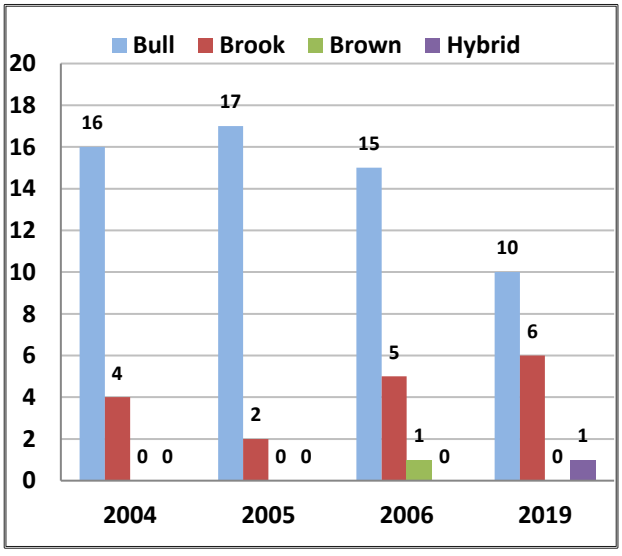


Figure 6. Number of bull trout, brook trout, brown trout, and bull X brook hybrids captured in 1000 feet of Soda Springs Creek at RM 0.3.

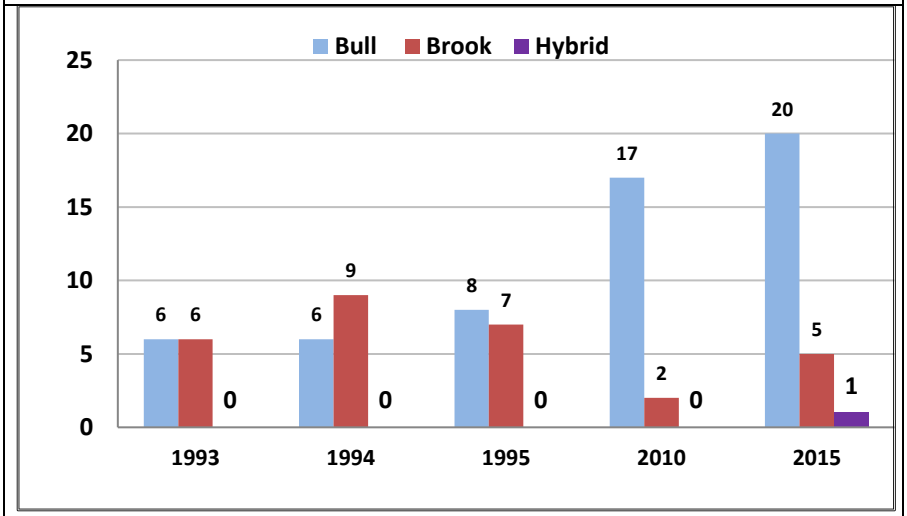


Blue Joint Creek is the largest of the tributaries that flows into Painted Rocks Reservoir. It is an important spawning and rearing tributary for migratory bull trout coming out of the reservoir, and for resident bull trout that reside in the Blue Joint headwaters. HUC 0106, which is densely roaded and part of the action area, encompasses the lower third of the Blue Joint Creek watershed. HUC 0105, which is unroaded and upstream of the action area, encompasses the upper two-thirds of the watershed and contains some of the best fish habitat in the West Fork Bitterroot River core area.

The Blue Joint local bull trout population may contain more than 1,000 adult resident bull trout, but fewer than 50 migratory adults (USDA Forest Service, 2013: pgs 210-212). The majority of the bull trout in the local population reside in HUC 0105 (Upper Blue Joint) (USDA Forest Service, 2013: pgs 210-212). The portion of Blue Joint Creek that flows through HUC 0106 is primarily a migratory corridor that links Painted Rocks Reservoir with pristine spawning and rearing habitat in the headwaters of HUC 0105. All of the bull trout in HUC 0106 overlap brook trout, and hybrids have been found. Brown trout are absent in the Blue Joint Creek watershed.

There is one long-term fish population monitoring reach in the Blue Joint Creek watershed, and it is located at RM 5.9 (near the Blue Joint trailhead), which is at the upstream end of HUC 0106. Figure 7 displays the numbers of bull trout, brook trout, and bull trout X brook trout hybrids that have been captured in the reach during mark/recapture electrofishing surveys. The data indicates that bull trout have increased a little bit since the early 1990's, while brook trout numbers have remained low.

Figure 7. Number of bull trout, brook trout, and bull X brook hybrids captured in 1000 feet of Blue Joint Creek at RM 5.9.



4.3 Westslope Cutthroat Trout Populations

Westslope cutthroat trout (westslope) are common throughout the action area and probably occupy close to 100% of their historic habitat. They are the most numerous fish species in all of the fish-bearing streams in the action area with the exception of the West Fork Bitterroot River.

Despite their widespread distribution across the project area, the westslope populations that reside in the streams with high levels of sediment (e.g. Buck, Fales, Beavertail, Took, Ditch, Line, Rombo, Blue Joint trib 3.8, and Mud creeks; see Figure 17) are thought to be suppressed populations. "Suppressed" means that the population likely contains fewer individuals than in would in its natural condition, and the adult fish in the population are fewer in number and of a smaller size than they would be in their natural condition. High sediment suppresses populations through the following mechanisms:

- Fewer eggs survive to hatch into fry
- Fewer fry survive to reach adulthood and reproductive age

- The adults that do survive to reproductive age are smaller due to a reduced macroinvertebrate food supply
- Smaller adults lay fewer eggs, and the cycle starts all over again.

Suppressed westslope populations are vulnerable to being displaced by brook trout, a non-native competitor that is a superior performer in high sediment conditions. Brook trout are present in most of the high sediment streams listed above, and in certain reaches like lower Took Creek, they have become the dominant species. In addition to being more vulnerable to displacement by non-native trout, suppressed westslope populations are also less resilient to disturbances such as fires, floods, and droughts.

In most cases, the high levels of sediment that lead to population suppression are caused by high road densities, particularly in watersheds that contain numerous road stream crossings. There are also a few streams where naturally high levels of sediment are caused by erosive geology, not by roads or human management. Fales and Line creeks are examples of that in the action area.

There are 25 streams in the action area that contain fish, and westslope cutthroat trout are the most numerous species in all of them with the exception of the West Fork Bitterroot River. Table 4 lists the streams that contain westslope cutthroat trout and the connectivity status (connected or isolated) of the populations.

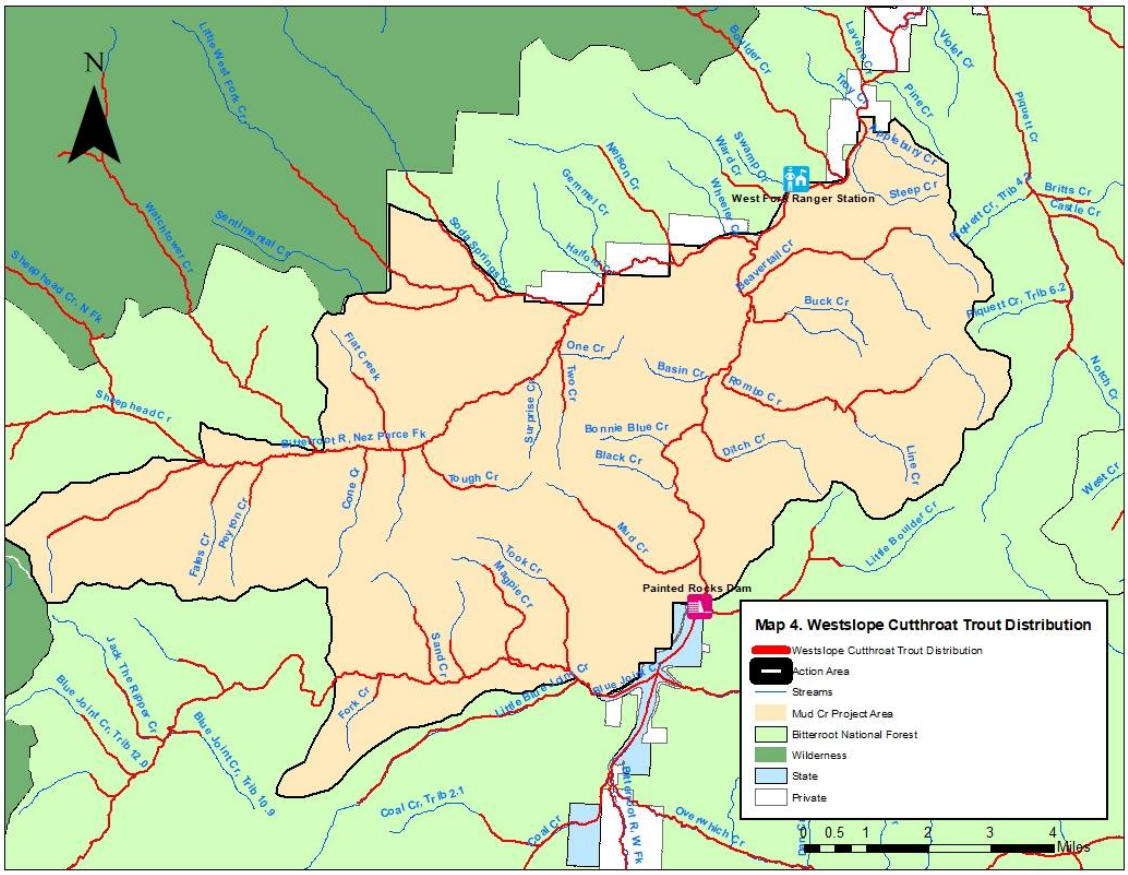
Table 4. Westslope Cutthroat Trout Streams in the Action Area

Stream	Tributary to	Connected or Isolated
West Fork Bitterroot River	Bitterroot River	Connected below Painted Rocks Dam
Beavertail Creek	West Fork Bitterroot River	Isolated and internally fragmented by culvert barriers
Buck Creek	West Fork Bitterroot River	Isolated by dewatering and culvert barriers on private land; lower end intermittent
Ditch Creek	West Fork Bitterroot River	Isolated by culvert barrier near mouth; lower end intermittent
Rombo Creek	West Fork Bitterroot River	Isolated and internally fragmented by culvert barriers
Line Creek	Rombo Creek	Connected
Mud Creek	West Fork Bitterroot River	Connected except for upper headwaters (culvert barrier)
Nez Perce Fork	West Fork Bitterroot River	Connected except for upper headwaters (culvert barriers)
Nelson Creek	Nez Perce Fork	Connected
Little West Fork	Nez Perce Fork	Connected
Soda Springs Creek	Little West Fork	Connected
Sentimental Creek	Little West Fork	Connected
Two Creek	Nez Perce Fork	Isolated and internally fragmented by culvert barriers; lower end intermittent
Tough Creek	Nez Perce Fork	Connected
Nez Perce trib 8.0	Nez Perce Fork	Connected
Flat Creek	Nez Perce Fork	Isolated by culvert barrier at mouth
Cone Creek	Nez Perce Fork	Connected
Peyton Creek	Nez Perce Fork	Connected
Fales Creek	Nez Perce Fork	Connected
Blue Joint Creek	Painted Rocks Reservoir	Connected
Took Creek	Blue Joint Creek	Connected
Magpie Creek	Blue Joint Creek	Connected
Blue Joint trib 3.8	Blue Joint Creek	Isolated by culvert barrier near mouth
Sand Creek	Blue Joint Creek	Connected except for culvert barrier in headwaters
Fork Creek	Blue Joint Creek	Connected

The Bitterroot NF has approximately 60 presence/absence reaches (100 m in length) scattered throughout the fish-bearing streams the action area. Most of these reaches have been surveyed at least three times over the past 25 years, with widespread survey efforts occurring in 2005-10 and 2018-19. The 2018-19 surveys indicated that westslope were the dominant species in all of the reaches and their numbers have changed little over the past 25 years. Westslope cutthroat trout are easily the most numerous fish species in the presence/absence reaches, and in most reaches, they are the only fish species present.

The westslope cutthroat trout in the smaller tributary streams are resident life history fish, while a mix of resident and migratory life history forms occurs in the West Fork Bitterroot River, Painted Rocks Reservoir, and the lower ends of the larger tributaries such as the Nez Perce Fork and Blue Joint Creek. Limited genetic testing indicates that the westslope cutthroat trout populations in the tributary streams are pure genetic strains, while both pure strain and hybridized (with rainbow trout, *Oncorhynchus mykiss*) westslope cutthroat trout occur in the West Fork Bitterroot River below Painted Rocks Dam and the lower reaches of the Nez Perce Fork. Only pure strain westslope cutthroat trout occur in the portion of the action area above Painted Rocks Dam. The main impairments to westslope cutthroat trout in the action area are (1) fragmentation by culvert barriers; (2) high sediment levels in some streams; and (3) competition with non-native trout species (primarily brook trout) in some of the smaller tributaries. Map 4 displays the occupied westslope cutthroat trout habitat in the action area.

Map 4. Occupied Westslope Cutthroat Trout Habitat in the Action Area



Population monitoring in the larger streams in the action area indicates that the westslope cutthroat trout populations appear to be stable at good numbers on National Forest lands (Figures 8-14).

Figures 8 displays the number of westslope cutthroat trout captured in the Nez Perce Fork at RM 1.2 in single-pass electrofishing surveys. Figures 9 and 10 display the estimated number of westslope cutthroat trout > 5 inches in length in the Nez Perce Fork at RM 9.8 and RM 11.8 (mark-recapture surveys). The

data indicates that westslope cutthroat trout numbers have declined at RM 9.8 and increased at RM 11.8 since 1992. Trend at RM 1.2 is inconclusive due to the light nature of the survey effort.

Figure 8. Number of westslope cutthroat trout (all sizes combined) captured in a single 1000 foot pass of the Nez Perce Fork at RM 1.2.

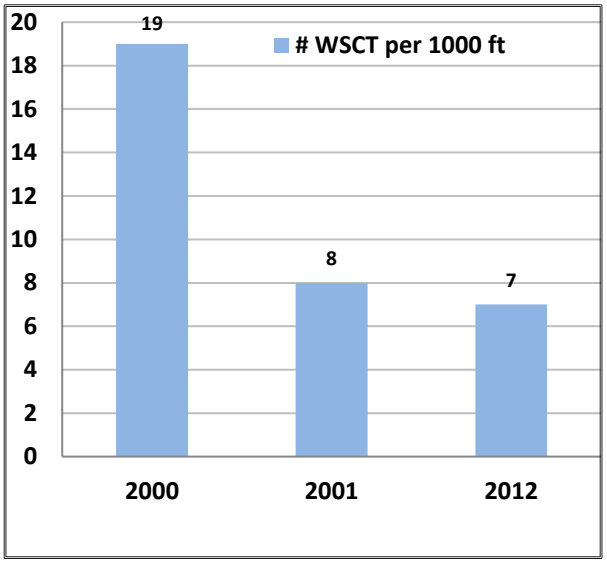


Figure 9. Estimated number of westslope cutthroat trout > 5 inches in length in the Nez Perce Fork at RM 9.8.

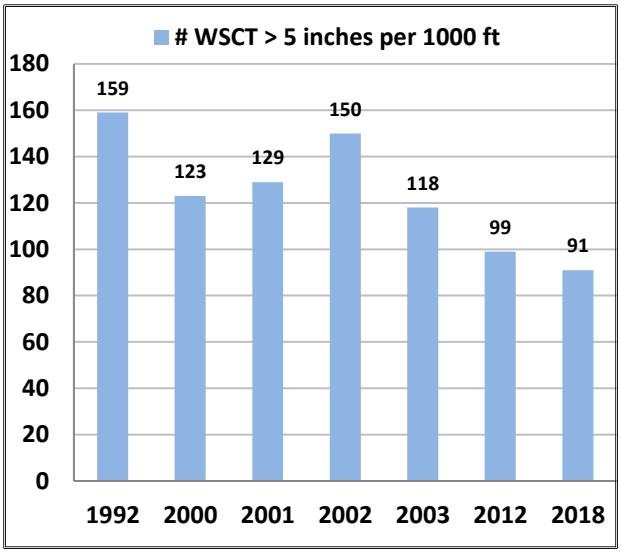
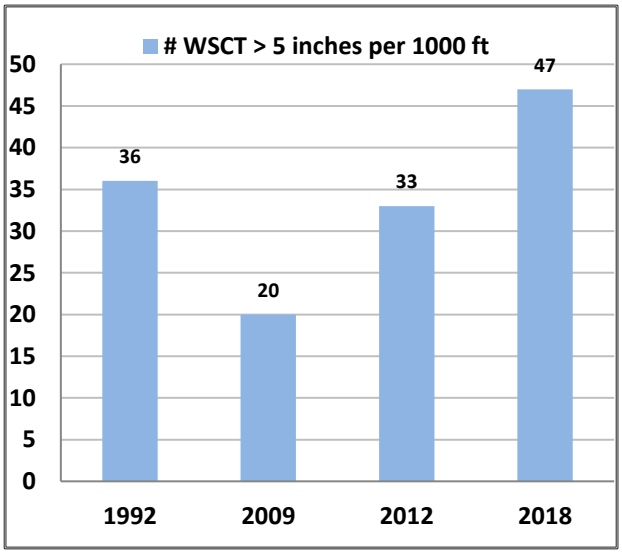


Figure 10. Estimated number of westslope cutthroat trout > 5 inches in length in the Nez Perce Fork at RM 11.8.



Figures 11, 12, and 13 display the estimated number of westslope cutthroat trout > 5 inches in length in the Little West Fork at RM 1.3 and RM 3.1, and in Soda Springs Creek at RM 0.3. The data indicates that westslope cutthroat trout numbers have increased in the Little West Fork and Soda Springs Creek since 1992 and 2004, respectively.

Figure 11. Estimated number of westslope cutthroat trout > 5 inches in length in the Little West Fork at RM 1.3.

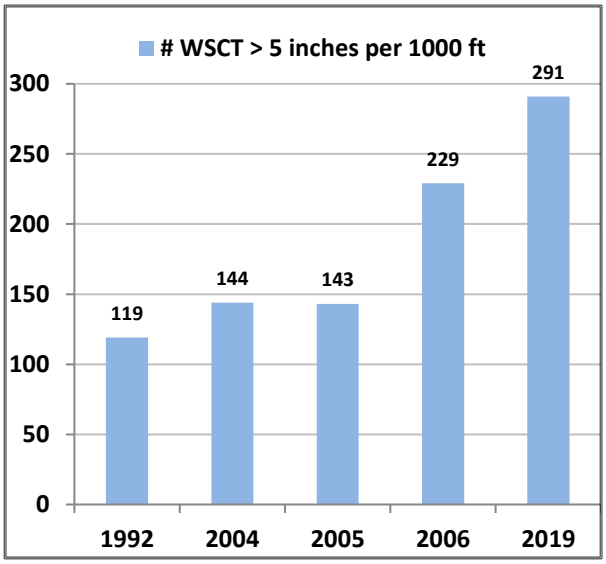


Figure 12. Estimated number of westslope cutthroat trout > 5 inches in length in the Little West Fork at RM 3.1.

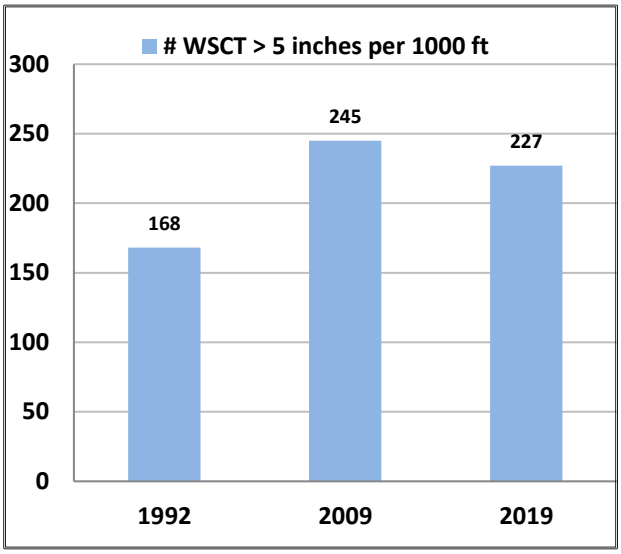


Figure 13. Estimated number of westslope cutthroat trout > 5 inches in length in Soda Springs Creek at RM 0.3.

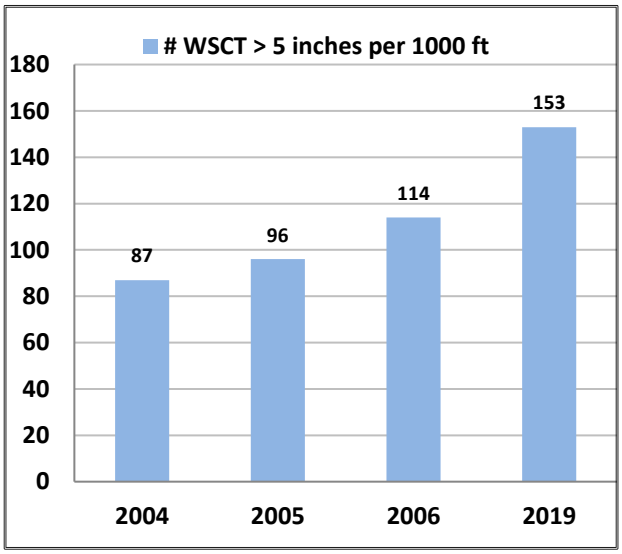
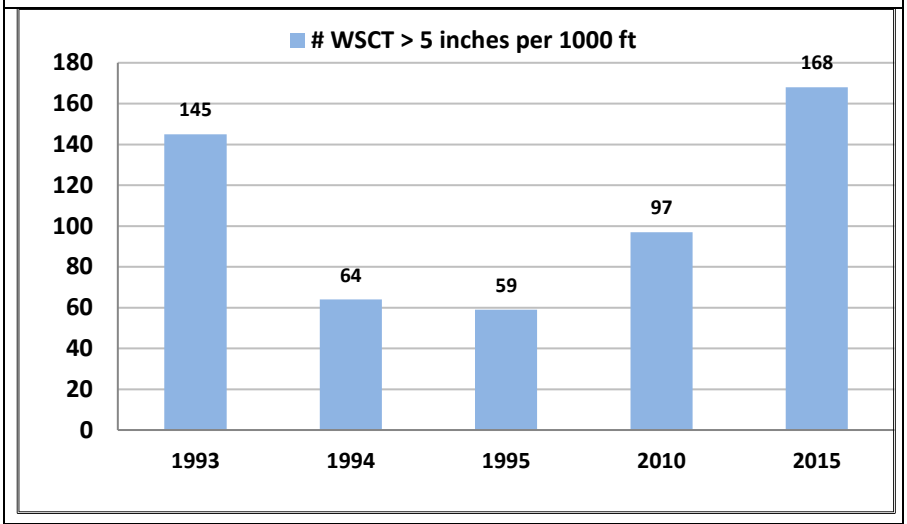


Figure 14 displays the estimated number of westslope cutthroat trout > 5 inches in length in Blue Joint Creek at RM 5.9. Westslope cutthroat trout numbers dipped in the mid 1990's but have rebounded since and were higher in 2015 than in previous years.

Figure 14. Estimated number of westslope cutthroat trout> 5 inches in length in Blue Joint Creek at RM 5.9.



4.4 Western Pearlshell Mussel Populations

The western pearlshell mussel was added to the Bitterroot NF's sensitive species list in 2010. It is the only native mussel that occurs west of the Continental Divide in Montana. The preferred habitat is cool to coldwater running streams with stable pebble and gravel substrates and low to moderate gradients (1-2%) (Stagliano, 2010: pgs 25-26). These types of streams are generally equivalent to the Rosgen C4 channel type (Rosgen, 1996: pgs 5-96 to 5-99). The average wetted stream width that viable western pearlshell mussel populations have been found in is 5.2 m plus/minus 1 m (14-20 feet) (Stagliano, 2010: pg 25). Western pearlshell mussels are usually absent in streams smaller than 2 m (6.6 feet) wide. Sometimes, western pearlshell mussels are found in larger rivers embedded in sand or gravel substrates tucked among boulders and cobbles. An example of this on the Bitterroot NF would be the Selway River. Western pearlshell mussels require a salmonid host to complete their life cycle. In western Montana, that host is usually the westslope cutthroat trout.

Western pearlshell mussels or shells have only been detected in six streams on or near the Bitterroot NF. The six streams are:

1. Cameron Creek (mouth to upper end of Shining Mountain Ranch)
2. Little Sleeping Child Creek (below private irrigation impoundments)
3. East Fork Bitterroot River (near mouths of Cameron, Laird, and Medicine Tree creeks, only shells have been found)
4. West Fork Bitterroot River (mouth to Painted Rocks Dam, eDNA sampling)
5. Bitterroot River (near Darby)
6. Selway River (multiple locations)

The viability of the western pearlshell mussel populations in Cameron Creek and Little Sleeping Child Creek is rated as "good/fair", while the populations in the East and West Forks of the Bitterroot River are rated as having "poor" viability (Stagliano, 2015; pgs 32-33). The viability of the Bitterroot River population is rated as "fair/poor" (Stagliano, 2015, pg 32). The Selway River population is not included in Stagliano's reports (2010, 2015), but it is likely the healthiest population on the Bitterroot NF.

Prior to 2019, the only way to survey for the presence of western pearlshell mussels was with snorkeling or a plexiglass-bottomed bucket. The mussels tend to be cryptic and difficult to see, and neither method was very reliable. Some snorkel/bucket surveys were conducted in the larger streams in the action area (Nez Perce Fork, Little West Fork, Blue Joint Creek, West Fork Bitterroot River) between 2007 and 2018, but no live mussels or shells were found during any of those surveys. Of those streams, the Nez Perce Fork was the most intensely surveyed. In 2008, an angler found a live mussel in the West Fork Bitterroot River at the Applebury boat launch, which is a little over a mile downstream from the lower end of the action area. That is the nearest confirmed sighting and the only mussel (dead or alive) ever reported in the West Fork Bitteroot River.

In 2019, a much more powerful new technology became available for detecting the presence of western pearlshell mussels. That technology is called environmental DNA (eDNA), and it involves pumping five liters of stream water through a very fine filter and then analyzing the filter for fragments of DNA that are specific only to the western pearlshell mussel. In November 2019, eDNA samples were collected from 13 sites within or downstream from the Mud Creek action area. The collection sites are listed below in Table 5, along with the results of the laboratory analysis that was conducted by the Rocky Mountain Research Station's National Genomics Center for Wildlife and Fish Conservation (Missoula, MT).

Table 5. Western Pearlshell Mussel eDNA Collection Sites and Results

Stream	Location	Mussels Detected?
West Fork Bitterroot River	WW White boat launch	Yes
West Fork Bitterroot River	Job Corps boat launch	Yes
West Fork Bitterroot River	FR 49 bridge	Yes
West Fork Bitterroot River	Applebury boat launch	Yes
West Fork Bitterroot River	Canoe boat lauch	Yes
West Fork Bitterroot River	Marti's Bridge boat launch	No
West Fork Bitterroot River	Bonnie Blue boat launch	Yes
Nez Perce Fork	Above mouth of Nelson Creek	No
Nez Perce Fork	FR 732 bridge	No
Nez Perce Fork	FR 5644 bridge	No
Little West Fork	FR 468 bridge	No
Blue Joint Creek	FR 5656 bridge	No
Piquett Creek	FR 49 bridge	No

Analysis of the eDNA samples was conducted in April, 2020 by the Rocky Mountain Research Station's National Genomics Center for Wildlife and Fish Conservation, which is located on the University of Montana campus in Missoula, MT. The analysis detected western pearlshell mussels at 6 of the 7 sample sites in the West Fork Bitterroot River (Table 5), but did not detect mussels in any of the tributaries that were sampled. Based on this analysis, this BA/BE concludes that western pearlshell mussels are present throughout the West Fork Bitterroot River below Painted Rocks Dam, but absent in the tributary streams in the action area.

4.5 Non-Native Species

Three non-native trout species are present in the action area – brook trout, brown trout, and rainbow trout. Brook trout are present above and below Painted Rocks Dam in the main stems of lower Blue Joint Creek, the Nez Perce Fork, and the West Fork Bitterroot River, and in the lower ends of some of the smaller tributaries. In general, brook trout are a "small stream fish" in the action area, meaning that they tend to be more common in the smaller tributaries and less common in the larger streams. Brown trout are only found below Painted Rocks Dam where they are common in the West Fork Bitterroot River, and present at low densities in the Nez Perce Fork and the lower reaches of the Little West Fork and Soda Springs Creek. Brown trout are believed to be slowly expanding their numbers and upstream distribution in the Nez Perce Fork drainage, and may also be doing so in the Little West Fork. Similar to brown trout, rainbow trout are only found below Painted Rocks Dam, primarily in the West Fork Bitterroot River and extreme lower end of the Nez Perce Fork. Brook trout are hybridizing with bull trout wherever the two species' distributions overlap, and rainbow trout are hybridizing with westslope cutthroat trout in the West Fork Bitterroot River below Painted Rocks Dam and the lower end of the Nez Perce Fork.

4.6 Environmental Baseline

The environmental baseline incorporates the past and present impacts of all Federal, State, or private actions and other human activities in the action area. The 50 CFR 402.02 states: "The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process." All of the ongoing Federal activities in the action area have been through section 7 consultation.

The effects of past and ongoing activities within the Bitterroot NF are summarized in the November, 2017 update of the watershed baseline. In order to rate the functional condition of the habitat indicators in the baseline, GIS layers were compiled for all of the bull trout forests in USFS Region One. The GIS layers analyzed various features on the Forest, including: barriers to fish movement, road density and proximity to streams, and the portion of watersheds in equivalent clearcut condition. The layers and their GIS-derived functional ratings were reviewed by Forest biologists and refined, where appropriate, with locally collected data. This information was then used to assess the most important attributes of bull trout habitat: temperature, barriers, pools, and sediment (Table 6). These attributes mirror the well-established "four Cs" that summarize good bull trout habitat – cold, clean, complex, and connected. For a complete list of habitat indicators and their functional ratings see Section 6 in this BA/BE, the Matrix Checklist.

Table 6 summarizes the current functional ratings for the six 6th level HUCs that make up the vast majority of the action area. HUCs 0105 (Upper Blue Joint Creek), 0201 (Sheephead Creek), 0202 (Watchtower Creek), 0302 (Boulder Creek), and 0303 (Piquett Creek) are not included in Table 6 because their total acreage (367 acres) in the action area is inconsequential.

Table 6. Functional Ratings for Temperature, Barriers, Pools, and Sediment in the Action Area

Indicator	HUC 0106	HUC 0108	HUC 0203	HUC 0204	HUC 0301	HUC 0305
Temperature	FAR	FAR	FAR	**FUR** (FAR)	FAR	FUR
Barriers	**FA** (FAR)	FAR	FA	FAR	FAR	**FAR** (FUR)
Pools	**FAR** (FUR)	FAR	FAR	**FAR** (FUR)	FUR	FAR
Sediment	**FAR** (FUR)	FAR	FA	FUR	**FAR** (FUR)	FAR

FUR = Functioning at Unacceptable Risk. FAR = Functioning at Risk. FA = Functioning Appropriately

This BA/BE is proposing seven changes to the functional ratings in the baseline. In Table 6, the recommended functional rating is highlighted in **BOLD**; the GIS rating that we would like to change is in parenthesis. The rationale for the proposed changes are described below.

(1) In HUC 0106, the *Barriers* indicator should be upgraded to FA. All of the culvert barriers in HUC 0106 that previously blocked or impeded bull trout movement have been replaced with fish passable structures. There are still a couple of culvert barriers on small tributaries to Blue Joint Creek (unnamed tributary 3.8 and upper Sand Creek), but these affect westslope cutthroat trout and not bull trout. To the best of our knowledge, all of the suitable habitat for bull trout in HUC 0106 is accessible and connected (USDA Forest Service, 2013: pg 214).

(2) In HUC 0106, the *Pool Frequency and Quality* indicator should be upgraded to FAR. The only bull trout habitat in HUC 0106 occurs in Blue Joint and Little Blue Joint creeks. Blue Joint Creek is the arterial stream in the HUC, and Little Blue Joint Creek is its largest tributary. Blue Joint Creek is a large (wetted width range 30-35 feet) C3 channel type; Little Blue Joint Creek is a smaller (wetted width range 10-15 feet) B4 channel type. I-walk habitat surveys indicate that pool frequencies in both streams (19/mile in Blue Joint; > 100/mile in Little Blue Joint) are within the FA range (USFWS, 1998a: pg 21), and the pools have good cover and minimal reduction in volume due to sediment. Pool spacing in Blue Joint Creek occurs about every 5-7 bankfull channel widths, which is within the reference range reported by Rosgen (1996: pg 5-92). Impacts on pools from near-stream roads are scattered and small scale. About 550 feet of FR 362 is located within 100 feet of Blue Joint Creek; about 2,155 feet of FRs 5656 and 5658 are located within 100 feet of Little Blue Joint Creek. Overall, road location appears to be having a minor impact on

pools, primarily adjacent to a few dispersed campsites where large wood recruitment has been reduced by streamside firewood cutting. Similar rationale is stated on page 214 of the Bull Trout Conservation Strategy (USDA Forest Service, 2013).

(3) In HUC 0106, the *Sediment* indicator should be upgraded to FAR. Blue Joint Creek is a relatively clean, cobble/boulder stream. The 2019 sediment surveys using the PIBO methodology measured surface fines at 3% < 2 mm and 7% < 6 mm in a lower reach of Blue Joint Creek, and 1% < 2 mm and 2% < 6 mm in an upper reach below the Blue Joint trailhead (Figure 17). These numbers meet FA criteria, but the presence of some near-stream FR 362 road segments increases risk somewhat, so the FAR rating is most appropriate. The small, non-bull trout tributaries in HUC 0106 that drain roaded watersheds (Took, Magpie, Sand, Blue Joint trib 3.8) have higher levels of sediment, but collectively they contribute only a tiny fraction of Blue Joint Creek's total water and sediment load. The median substrate index score in Took Creek PIBO site #265 is at the 50th percentile of managed sites on the Bitterroot NF and below the 25th percentile of reference sites (USDA Forest Service, 2020). The pool fines index score is just below the 90th percentile of managed sites on the Bitterroot NF and near the 75th percentile of reference sites (USDA Forest Service, 2020). Collectively, the data described above suggests that sediment is probably not limiting the quality of bull trout habitat in HUC 0106, which is consistent with the findings in the Bull Trout Conservation Strategy (USDA Forest Service, 2013: pgs 212-214).

(4) In HUC 0204, the *Temperature* indicator should be downgraded to FUR. The Bull Trout Conservation Strategy gave the *Temperature* indicator a FAR rating (USDA Forest Service, 2013: pgs 251-252), but this BA is proposing to downgrade that rating to FUR. In its current temperature regime, it is highly unlikely that bull trout will ever be able to recover in the Nez Perce Fork. At the same time, non-native brown and brook trout appear to be taking advantage of the warmer waters to expand their numbers and distributions while bull trout continue to decline (Figures 2 and 3). The Bitterroot Headwaters TMDL concluded that the Nez Perce Fork is thermally impaired, with the loss of overstory shade from main (i.e. FR 468) and secondary roads being the primary causes (MDEQ, 2005: pg 208). About 2.5 miles of FR 468 is located within 100 feet of the Nez Perce stream channel. This has caused widespread reductions in overstory shade along the north side of the creek. Thermograph data indicates that 7-day mean-maximums at RM 1.0 are in the 17.5° to 19°C range, while those at RM 11.0 are in the 14.5° to 16° C range. The trend at both sites has been increasing (Figure 15), and neither site is meeting its water quality goal temperatures. For those reasons, FUR is the most appropriate rating.

(5) In HUC 0204, the *Pool Frequency and Quality* indicator should be upgraded to FAR. I-walk habitat surveys in the Nez Perce Fork indicate 26 pools/mile (Table 7). This number meets FA criteria (USFWS, 1998a: pg 21); however, quality is reduced because of the near-stream location of FR 468 which reduces wood recruitment and increases sediment delivery. On the positive side, large wood is the main pool-forming feature in the Nez Perce Fork, and current levels (65 INFISH pieces/mile) and future recruitment potential is in good condition as a result of recent beetle epidemics which have left numerous dead standing snags throughout the Nez Perce Fork RHCA. For the reasons stated above, FAR is the most appropriate rating for the *Pool Frequency and Quality* indicator in HUC 0204 at this time. FAR is also the rating in the Bull Trout Conservation Strategy (USDA Forest Service, 2013: pgs 251-252).

(6) In HUC 0301, the *Sediment* indicator should be upgraded to FAR. There are only two bull trout streams in HUC 0301, the West Fork Bitterroot River and Rombo Creek. The HUC 0301 portion of the West Fork Bitterroot River is located immediately downstream of Painted Rocks Dam and Painted Rocks Reservoir. The reservoir acts as a large sediment trap. As a result, over the past 80 years the West Fork below the dam has changed from a braided, highly sinuous channel to a more simplified, armored, and less sinuous one. Numerous gravel bars and channel braids evident in 1954 aerial photos are now vegetated and no longer apparent in the aerial imagery. The result is a simplified river channel with a sediment-starved substrate dominated by boulders and cobbles with low amounts of gravels and fines. The data collected from 2019 grid tosses is supportive of the sediment-starved condition (surface fines 0.2% < 2 mm and 2% < 6 mm) (Figure 17). These numbers meet FA criteria. Rombo Creek contains a small bull trout population that is isolated to about 2.5 miles of occupied habitat between the Forest boundary and the FR 13462 crossing. The 2019 sediment surveys using the PIBO methodology measured surface fines at 20% < 2 mm and 34% < 6 mm in Rombo Creek (Figure 17). These levels are elevated, and forest roads and fire

are believed to be the primary sources. Overall, the vast majority of the suitable bull trout habitat in HUC 0301 occurs in the West Fork Bitterroot River where sediment is not adversely affecting habitat quality.

(7) In HUC 0305, the *Barriers* indicator should be upgraded to FAR. The only bull trout habitat in the HUC occurs in the West Fork Bitterroot River (FMO critical habitat), and it contains no barriers. There are culvert barriers near the mouths of seven small westslope cutthroat trout tributaries that pass under the West Fork Highway. The culverts isolate those populations, but bull trout have never been found in the isolated tributaries, and none are believed to be large enough to provide suitable habitat for bull trout. To the best of our knowledge, all of the suitable habitat for bull trout in HUC 0305 is accessible and connected.

A quick glance at the functional ratings in Table 6 shows a preponderance of FAR indicators with a few FUR indicators mixed in. The FUR indicators are *Temperature* and *Sediment* in the Nez Perce Fork (HUC 0204), *Pool Frequency and Quality* in the West Fork Bitterroot River between Painted Rocks Dam and the Nez Perce Fork (HUC 0301), and *Temperature* in the lower West Fork Bitterroot River below the Nez Perce Fork (HUC 0305).

4.7 Bull Trout Conservation Strategy

Pages 210-214 and 246-253 in the Bull Trout Conservation Strategy (USDA Forest Service, 2013) provides an overview of habitat conditions and threats in the Mud Creek action area. In the lower Blue Joint watershed (HUC 0106), brook trout are the primary threat to the local bull trout population; a secondary threat is water temperature increases from the 2000 fires, which have been gradually moderating over the past two decades with the recovery of riparian vegetation. In the Nez Perce Fork (HUC 0204) and Little West Fork (HUC 0203) watersheds, the primary threats are overlap with non-native fish (brook trout and brown trout) and habitat reductions (increased temperature and sediment, reduced woody debris recruitment) caused by the near-stream location of roads, especially FR 468 along the Nez Perce Fork. The action area portion of the West Fork Bitterroot River below Painted Rocks Dam (HUCs 0301 and 0305) was not included in the Bull Trout Conservation Strategy (USDA Forest Service, 2013).

Pages 213-214, 247, and 252 in the Bull Trout Conservation Strategy (USDA Forest Service, 2013) recommends several restoration actions for the Blue Joint Creek and Nez Perce Fork local populations. These are listed below (*in italics*), along with a short description of how or if the Proposed Federal Action would move the local population closer to meeting the restoration recommendations.

HUC 0106 (Lower Blue Joint Creek):

- *Coordinate with Montana FWP in developing management actions that reduce the numbers and distribution of brook trout (pg 213).*

  This recommendation is outside the scope of the Mud Creek Project.

- *Reduce road densities, the length of road in RHCAs, and the number of road stream crossings (pgs 213-214).*

  Under the Proposed Federal Action, the road density in HUC 0106 would be reduced from 8.88 miles/mile^{2}to 7.56 miles/mile^2, the length of road in RHCAs would be reduced from 14.1 miles to 12.49 miles, and the number of road stream crossings would be reduced from 128 to 112 (Table 2).

- *Minimize impacts (e.g. shade losses from firewood cutting) from dispersed camping along Blue Joint Creek (pgs 213-214).*

  Several non-system 2-track roads that firewood cutters have created to access firewood in the Blue Joint Creek RHCA would be blocked off, obliterated, and revegetated as part of the Proposed Federal Action.

- *Where feasible, relocate near-stream segments of Roads 362 along Blue Joint Creek and Road 5656 along Little Blue Joint Creek out of RHCAs. Opportunities are limited due to topography and costs (pg 213).*

  The Proposed Federal Action would not relocate these routes.

HUC 0204 (Nez Perce Fork)

- *Coordinate with Montana FWP in developing management actions that reduce the numbers and distribution of non-native trout (pg 247).*

  This recommendation is outside the scope of the Mud Creek Project.

- *Where feasible, relocate the near-stream segments of Road 468 out of the Nez Perce Fork RHCA. Where relocation is infeasible, take actions to reduce the road's impact on habitat in the Nez Perce Fork (e.g. surfacing with gravel or pavement, moving short segments further from the stream, restoring conifer overstory where opportunities exist (pg 247).*

  The Proposed Federal Action would not relocate FR 468 out of the Nez Perce Fork RHCA. However, the Forest has applied for other funding unrelated to the Mud Creek Project to spot pave approximately two miles of FR 468 segments that are located within 100 feet of the Nez Perce Fork and are currently unpaved. The segments are located between the FR 732 junction and the start of the existing pavement near Fales Flat campground. If paving cannot be conducted, an alternative would be to re-surface the near-stream segments with bentonite gravel.

- *Eliminate three culvert barriers (Flat Creek, Road 468; upper and lower paved Road 468 crossings of the upper Nez Perce Fork) that currently limit the distribution of bull trout. Flat Creek is the #1 priority – it could potentially open up about 1.7 miles of small stream spawning and rearing habitat. The Road 468 culverts on the Nez Perce Highway are lower priority (pg 252).*

  The NEPA for these three culvert replacements was completed in the West Fork District Fish Culverts EA (Decision Notice signed January 4, 2010). Funding is needed to conduct the engineering surveys and implement the replacements.

4.8 PIBO Effectiveness Monitoring

There is one PIBO effectiveness monitoring reach in the Mud Creek action area. The reach is located in the lower end of Took Creek (site #265), which is a small, non-bull trout tributary to lower Blue Joint Creek in HUC 0106. Site #265 was surveyed in 2004, 2009, and 2019. The site is located in a low gradient, partially forested meadow with dense riparian shrubs along its banks. Silt and sand are the dominant stream bottom particles (d50 = 2 mm). Site #265 contains a narrow stream channel (bankfull width-depth ratio = 7.3; wetted width-depth ratio = 15.9), a below average pool frequency (237 pools/mile), and low amounts of large wood (66 PIBO category 1 pieces/mile). The overall habitat index value for site #265 is low, ranking just above the 10th percentile of managed sites on the Bitterroot National Forest, and well below the 10th percentile of reference sites on the Forest (USDA Forest Service, 2020).

4.9 TMDLs

In 2005, the Montana Department of Environmental Quality (MDEQ) completed the "*Water Quality Restoration Plan and Total Maximum Daily Loads for the Bitterroot Headwaters Planning Area*" (MDEQ, 2005), which is referred to as the Bitterroot Headwaters TMDL in this BA/BE. The assessment area for the Bitterroot Headwaters TMDL included the Mud Creek action area.

Four streams in the Mud Creek action area (West Fork Bitterroot River, Nez Perce Fork, Buck Creek, and Ditch Creek) were studied for potential water quality impairments in the Bitterroot Headwaters TMDL. MDEQ made the following determinations:

- The West Fork Bitterroot River (all segments) is impaired by siltation and thermal modification.
- The Nez Perce Fork is impaired by thermal modification.
- Buck Creek (a small tributary to the West Fork) is impaired by siltation.

- Ditch Creek (a small tributary to the West Fork) is impaired by siltation.

TMDLs and water quality goals were established for each of these impaired water bodies.

4.10 INFISH RMOs

This section discloses the existing condition of the INFISH Riparian Management Objectives (RMOs) in the Mud Creek action area. INFISH amended the Bitterroot Forest Plan in 1995 (USDA Forest Service, 1995). INFISH established RMOs that apply to fish-bearing streams on National Forest lands. The RMOs describe features that should generally be met in streams that contain good fish habitat. In order for the RMOs to apply to a given stream, the stream must support fish and be at least partially located on National Forest land. There are 25 streams in the action area that meet these criteria. They are:

1. West Fork Bitterroot River	2. Nez Perce Fork	3. Blue Joint Creek
4. Little West Fork	5. Soda Springs Creek	6. Sentimental Creek
7. Nelson Creek	8. Two Creek	9. Tough Creek
10. Nez Perce unnamed trib 8.0	11. Flat Creek	12. Cone Creek
13. Peyton Creek	14. Fales Creek	15. Beavertail Creek
16. Buck Creek	17. Ditch Creek	18. Rombo Creek
19. Line Creek	20. Mud Creek	21. Took Creek
22. Magpie Creek	23. Sand Creek	24. Blue Joint unnamed trib 3.8
25. Fork Creek		

In the fish-bearing streams listed above, four RMOs were evaluated for this project:

1. pool frequency
2. large woody debris frequency
3. wetted width-depth ratio
4. water temperature

The RMOs for bank stability and lower bank angle were not evaluated because they are only applicable in non-forested systems. All of the streams in the Mud Creek action area are forested systems. The RMOs were not modified for this project. The default numeric criteria described on page A-4 of the INFISH Decision Notice (USDA Forest Service, 1995) were used.

INFISH did not establish an RMO for sediment. However, because it is such an important habitat feature for streams on the Bitterroot NF, this BA/BE essentially treats sediment as an RMO and a discussion of sediment conditions is included in this section.

Using the PIBO dataset, Kershner and Roper (2010) compared the RMOs in randomly selected reference and managed stream reaches across the interior Columbia River basin. Four of the RMOs (pool frequency, wetted width-depth ratio, bank stability and lower bank angle) showed no significant differences between referenced and managed sites; only the large woody debris frequency and water temperature RMOs were statistically better in reference reaches than in managed reaches. Also, of the 726 reaches that were evaluated, none exceeded all of the RMOs at a single site (Kershner and Roper, 2010).

4.10.1 Pool Frequency RMO

Table 7 summarizes the current status of the Pool Frequency RMO in the fish-bearing streams. The numeric range for the RMO is based on the mean wetted width of the stream channel. Streams not meeting the RMO are highlighted in Table 7.

Table 7. Pool Frequency RMO

Stream	6th level HUC	Mean Wetted Width Category (feet)	RMO (# / mile)	Existing Condition (# / mile)	Survey Year[1]
West Fork Bitterroot River	0301	50-75	23-26	9	2019
West Fork Bitterroot River	0305	75-100	18-23	7	2019
Nez Perce Fork	0204	25-50	26-47	26	2019
Blue Joint Creek	0106	25-50	26-47	19	2017
Little West Fork	0203	25-50	26-47	38	2019
Soda Springs Creek	0203	10-20	56-96	76	2019
Nelson Creek	0204	10-20	56-96	92	2019
Beavertail Creek	0301	< 10	> 96	238	2019
Blue Joint tributary 3.8	0106	< 10	> 96	237	2019
Buck Creek	0301	< 10	> 96	206	2019
Cone Creek	0204	< 10	> 96	227	2019
Ditch Creek	0301	< 10	> 96	232	2017
Fales Creek	0204	< 10	> 96	180	2019
Flat Creek	0204	< 10	> 96	176	2012
Fork Creek	0106	< 10	> 96	201	2020
Line Creek	0301	< 10	> 96	253	2019
Magpie Creek	0106	< 10	> 96	206	2019
Mud Creek	0301	< 10	> 96	180	2019
Nez Perce tributary 8.0	0204	< 10	> 96	143	2019
Peyton Creek	0204	< 10	> 96	164	2019
Rombo Creek	0301	< 10	> 96	211	2019
Sand Creek	0106	< 10	> 96	385	2019
Sentimental Creek	0203	< 10	> 96	200	2019
Took Creek (PIBO)	0106	< 10	> 96	237	2019
Took Creek (I-walk)	0106	< 10	> 96	232	2019
Tough Creek	0204	< 10	> 96	200	2019
Two Creek	0204	< 10	> 96	253	2019

[1] All of the surveys listed in Table 7 used the I-walk inventory method to count pools. For Took Creek, both the most recent PIBO inventory (2019) and the I-walk survey results are listed

Lower Blue Joint Creek (HUC 0106). HUC 0106 contains the portion of Blue Joint Creek between Painted Rocks Reservoir and the Blue Joint Trailhead, including the fish-bearing tributaries of Took, Magpie, unnamed tributary 3.8, Sand, and Fork creeks. The HUC 0106 portion of Blue Joint Creek contains 19 pools per mile (Table 7). This is lower than the RMO (26-47 pools/mile) but within the FA range listed in the Baseline Matrix (USFWS, 1998a: pg 21), and the reference condition range for C3 channels reported by Rosgen (1996: pg 5-92). The HUC 0106 portion of Blue Joint Creek is a large, riffle-dominated C3 channel which is believed to contain pool frequencies and qualities that are close to their natural condition. The fish-bearing tributaries to Blue Joint Creek are all small (< 10 feet wetted width), and all are meeting their RMOs with pool frequencies > 200 per mile (Table 7). PIBO site #265 in Took Creek contains 237 pools/mile (Table 7). This frequency meets the RMO but is near the 25th percentile for managed and reference sites on the Bitterroot NF (USDA Forest Service, 2020). GIS rates the *Pool Frequency & Quality* and *Large Pools* indicators in HUC 0106 as FUR. For the reasons described above and in Section 4.6, this BA/BE proposes to change the functional ratings of both indicators to FAR.

Painted Rocks Lake (HUC 0108). There are no fish-bearing streams in the action area portion of HUC 0108. The only water bodies in the action area are Painted Rocks Reservoir and three non-fish bearing

intermittent tributaries that drain into the reservoir from the west between Painted Rocks Dam and Blue Joint Bay. Pools were not counted or measured in those intermittent streams.

Little West Fork (HUC 0203). HUC 0203 contains the Little West Fork Creek and its fish-bearing tributaries of Soda Springs and Sentimental creeks. The Little West Fork contains 38 pools per mile (Table 7), which is meeting the RMO (26-47 pools/mile). Soda Springs and Sentimental creeks are also meeting their RMOs with pool frequencies of 76/mile and 200/mile, respectively (Table 7). Overall, pool frequency and quality are close to natural condition in HUC 0203 and only minimally affected by man's activities. GIS rates the *Pool Frequency & Quality* and *Large Pools* indicators in HUC 0203 as FAR. This BA/BE proposes no changes to those indicators.

Nez Perce Fork (HUC 0204). HUC 0204 contains the Nez Perce Fork and its fish-bearing tributaries of Nelson, Two, Tough, unnamed tributary 8.0, Flat, Cone, Peyton, and Fales creeks. The Nez Perce Fork contains 26 pools per mile (Table 7), which is meeting the RMO (26-47 pools/mile). The pool frequency in the Nez Perce Fork meets FA criteria in the Baseline Matrix (USFWS, 1998a: pg 21). However, pool quality is reduced because of the near-stream location of FR 468 which reduces wood recruitment and increases sediment delivery. On the positive side, large wood is the main pool-forming feature in the Nez Perce Fork, and current levels (65 INFISH pieces/mile) and future recruitment potential of large wood is still in good condition as a result of recent beetle epidemics which have left numerous dead standing snags throughout the Nez Perce Fork RHCA. The fish-bearing tributaries to the Nez Perce Fork are all meeting their RMOs with pool frequencies of 92/mile in Nelson Creek and 143-253/mile in the other tributaries (Table 7). GIS rates the *Pool Frequency & Quality* and *Large Pools* indicators in HUC 0204 as FUR. For the reasons described above and in Section 4.6, this BA/BE proposes to change the functional ratings of both indicators to FAR.

West Fork Bitterroot River-Rombo Creek (HUC 0301). HUC 0301 contains the portion of the West Fork Bitterroot River between Painted Rocks Dam and the Nez Perce Fork. The fish-bearing tributaries in HUC 0301 include Beavertail, Buck, Rombo, Line, Ditch, and Mud creeks. The HUC 0301 portion of the West Fork Bitterroot River contains 9 pools per mile (Table 7), which is lower than the RMO (23-26 pools/mile). Highway encroachment, the long-term effects of regulated flows from Painted Rocks Dam, and illegal cutting of instream wood by floaters are all thought to be causes of reduced pool habitat in the HUC 0301 portion of the West Fork. The fish-bearing tributaries in HUC 0301 are all meeting their RMOs with pool frequencies > 200/mile (Table 7). However, pool quality (volume and hiding cover) is reduced in the tributaries because of sediment infill. GIS rates the *Pool Frequency & Quality* and *Large Pools* indicators in HUC 0301 as FUR. This BA/BE proposes no changes to those indicators.

West Fork Bitterroot River-Lloyd Creek (HUC 0305). HUC 0305 contains the portion of the West Fork Bitterroot River between its mouth and the Nez Perce Fork, a distance of 15.6 river miles. Only the upper 2.1 miles of the river (from Boulder Creek to the Nez Perce Fork) is located within the action area. The HUC 0305 portion of the West Fork Bitterroot River contains 7 pools per mile (Table 7), which is lower than the RMO (18-23 pools/mile). Highway encroachment, the resulting loss of meanders, and permanent reductions in riparian overstory cover caused by developments such as roads, homes, and pastures has reduced pool frequency and quality in the HUC 0305 portion of the West Fork. GIS rates the *Pool Frequency & Quality* and *Large Pools* indicators in HUC 0305 as FAR. This BA/BE proposes no changes to those indicators.

4.10.2 Large Wood Debris Frequency RMO

Table 8 summarizes the current status of the Large Woody Debris Frequency RMO in the fish-bearing streams. The RMO is > 20 pieces per mile regardless of stream size. All of the streams in the action area are meeting the RMO.

Table 8. Large Woody Debris Frequency RMO

Stream	6th level HUC	Mean Wetted Width Category (feet)	RMO (# / mile)	Existing Condition (# / mile)	Survey Year[1]
West Fork Bitterroot River	0301	50-75	> 20	36	2019
West Fork Bitterroot River	0305	75-100	> 20	37	2019
Nez Perce Fork	0204	25-50	> 20	65	2019
Blue Joint Creek	0106	25-50	> 20	53	2017
Little West Fork	0203	25-50	> 20	145	2019
Soda Springs Creek	0203	10-20	> 20	206	2019
Nelson Creek	0204	10-20	> 20	76	2019
Beavertail Creek	0301	< 10	> 20	21	2019
Blue Joint tributary 3.8	0106	< 10	> 20	105	2019
Buck Creek	0301	< 10	> 20	37	2019
Cone Creek	0204	< 10	> 20	95	2019
Ditch Creek	0301	< 10	> 20	26	2017
Fales Creek	0204	< 10	> 20	153	2019
Flat Creek	0204	< 10	> 20	31	2012
Fork Creek	0106	< 10	> 20	62	2020
Line Creek	0301	< 10	> 20	158	2019
Magpie Creek	0106	< 10	> 20	190	2019
Mud Creek	0301	< 10	> 20	74	2019
Nez Perce tributary 8.0	0204	< 10	> 20	106	2019
Peyton Creek	0204	< 10	> 20	63	2019
Rombo Creek	0301	< 10	> 20	174	2019
Sand Creek	0106	< 10	> 20	105	2019
Sentimental Creek	0203	< 10	> 20	68	2019
Took Creek (PIBO)	0106	< 10	>20	66 [2]	2019
Took Creek (I-walk)	0106	< 10	> 20	58	2019
Tough Creek	0204	< 10	> 20	53	2019
Two Creek	0204	< 10	> 20	68	2019

[1] All of the surveys listed in Table 8 used the I-walk inventory method to count wood pieces. For Took Creek, both the most recent PIBO inventory (2019) and the I-walk survey results are listed.

[2]The PIBO methodology does not count INFISH sized pieces of wood. PIBO counts a smaller piece of wood called a "category 1" piece, which is> 1 meter long and > 0.1 meters in diameter. INFISH sized pieces of wood are> 10.6 meters long and > 0.3 meters in diameter.

Lower Blue Joint Creek (HUC 0106). The HUC 0106 portion of Blue Joint Creek contains 53 INFISH woody debris pieces per mile (Table 8), which is meeting the RMO and is close to its natural potential. There has been a lot of recent fire and beetle-killed recruitment into Blue Joint Creek, with numerous snags still standing along the stream banks. The fish-bearing tributaries to Blue Joint Creek that drain roaded watersheds (Took, Magpie, Sand, Blue Joint trib 3.8) are mostly unburned and are meeting their RMOs (Table 8). In some areas, the tributaries have received a lot of recent recruitment of beetle-killed Douglas fir and lodgepole pine snags. Fork Creek drains a roadless drainage that was burned at high severity in the upper half of its watershed in 2000. Large wood is common in Fork Creek and is meeting its RMO (Table 8). PIBO site #265 is located in a more open, meadow area where overstory trees are less common in the riparian area. The wood frequency index score in the site reflects this, being at the 10th percentile for managed sites on the Bitterroot NF and below the 10th percentile for reference sites (USDA Forest Service, 2020). The GIS rates the *Large Woody Debris* indicator in HUC 0106 as FUR. This BA/BE proposes to

change the functional rating to FAR. The data indicates that large wood is common in HUC 0106 and recruitment potential is not being substantially affected by roads or past timber harvest.

Painted Rocks Lake (HUC 0108). There are no fish-bearing streams in the action area portion of HUC 0108. The only water bodies in the action area are Painted Rocks Reservoir and three non-fish bearing intermittent tributaries that drain into the reservoir from the west between Painted Rocks Dam and Blue Joint Bay. Large wood was not counted in those intermittent streams.

Little West Fork (HUC 0203). The Little West Fork contains 145 INFISH woody debris pieces per mile (Table 8), which is meeting the RMO. Soda Springs and Sentimental creeks contain 206 and 68 INFISH woody debris pieces per mile, respectively (Table 8), which are also meeting the RMO. Woody debris function (frequencies, sizes, and future recruitment potential) is close to its natural condition in HUC 0203 with only a few small and scattered spots where road encroachment has reduced the riparian overstory. GIS rates the *Large Woody Debris* indicator in HUC 0203 as FAR. This BA/BE proposes no changes to the indicator.

Nez Perce Fork (HUC 0204). The Nez Perce Fork contains 65 INFISH woody debris pieces per mile (Table 8), which is meeting the RMO but is below its natural potential. Despite losses of riparian overstory cover due to the near-stream location of FR 468 (i.e. 2.5 miles of FR 468 is located within 100 feet of the stream channel), future wood recruitment potential still appears to be in good condition because of recent beetle epidemics that have left numerous dead standing snags throughout the Nez Perce Fork RHCA. The fish-bearing tributaries to the Nez Perce Fork are all meeting the RMO, but three of the tributaries (e.g. Two, Tough, and Flat creeks) have reduced wood recruitment resulting from near-stream road segments. GIS rates the *Large Woody Debris* indicator in HUC 0204 as FUR. For the reasons described above, this BA/BE proposes to change the functional rating to FAR. The data indicates that large wood is relatively common in HUC 0204, but there are areas of reduced recruitment due to near-stream roads.

West Fork Bitterroot River-Rombo Creek (HUC 0301). The HUC 0301 portion of the West Fork Bitterroot River contains 36 INFISH woody debris pieces per mile (Table 8), which is meeting the RMO but is below its natural potential. Highway encroachment has permanently reduced wood recruitment along some portions of the West Fork in HUC 0301, but in recent years, those reductions have been somewhat offset by accelerated recruitment of beetle-killed trees. A continuing problem is the illegal cutting of instream wood by floaters, particularly in the more meandering sections of river between the Nez Perce Fork and the Rombo campground. The fish-bearing tributaries in HUC 0301 are all meeting the RMO for large wood (Table 8). However, three of the tributaries (Beavertail, Buck, and Ditch creeks) have reduced frequencies and recruitment due to near-stream roads (Beavertail and Ditch creeks) and past riparian harvest (Buck Creek). GIS rates the *Large Woody Debris* indicator in HUC 0301 as FUR. This BA/BE proposes no changes to the indicator.

West Fork Bitterroot River-Lloyd Creek (HUC 0305). The HUC 0305 portion of the West Fork Bitterroot River contains 37 INFISH woody debris pieces per mile (Table 8), which is meeting the RMO but is below its natural potential. Highway encroachment and riverfront developments on private lands have permanently reduced wood recruitment along some portions of the West Fork in HUC 0305. Beetle kill has helped to increase woody debris recruitment recently. The best reaches with the most wood are located below the action area where the river's morphology and floodplain are less affected by the West Fork Highway (e.g. mouth to Conner Cutoff Road and between Lloyd and Christisen Creeks). GIS rates the *Large Woody Debris* indicator in HUC 0305 as FAR. This BA/BE proposes no changes to the indicator.

4.10.3 Wetted Width-Depth Ratio RMO

Table 9 summarizes the current status of the Wetted Width-Depth Ratio RMO in the fish-bearing streams. The RMO is a ratio < 10 regardless of stream size. Streams not meeting the RMO are highlighted in Table 9. None of the streams in the action area are meeting the RMO.

Table 9. Wetted Width-Depth Ratio RMO

Stream	6th level HUC	Mean Wetted Width Category (feet)	RMO	Existing Condition	Survey Year[1]
West Fork Bitterroot River	0301	50-75	< 10	64	2019
West Fork Bitterroot River	0305	75-100	< 10	83	2019
Nez Perce Fork	0204	25-50	< 10	57	2019
Blue Joint Creek	0106	25-50	< 10	60	2017
Little West Fork	0203	25-50	< 10	69	2019
Soda Springs Creek	0203	10-20	< 10	78	2019
Nelson Creek	0204	10-20	< 10	34	2019
Beavertail Creek	0301	< 10	<10	33	2019
Blue Joint tributary 3.8	0106	< 10	<10	81	2019
Buck Creek	0301	< 10	<10	16	2019
Cone Creek	0204	< 10	<10	33	2019
Ditch Creek	0301	< 10	<10	14	2017
Fales Creek	0204	< 10	<10	19	2019
Flat Creek	0204	< 10	<10	21	2012
Fork Creek	0106	< 10	< 10	18	2020
Line Creek	0301	< 10	< 10	27	2019
Magpie Creek	0106	< 10	< 10	71	2019
Mud Creek	0301	< 10	< 10	45	2019
Nez Perce tributary 8.0	0204	< 10	<10	27	2019
Peyton Creek	0204	< 10	< 10	36	2019
Rombo Creek	0301	< 10	<10	22	2019
Sand Creek	0106	< 10	< 10	28	2019
Sentimental Creek	0203	< 10	<10	34	2019
Took Creek (PIBO)	0106	< 10	<10	16	2019
Took Creek (I-walk)	0106	< 10	<10	36	2019
Tough Creek	0204	< 10	<10	34	2019
Two Creek	0204	< 10	< 10	52	2019

[1] All of the surveys listed in Table 9 used the I-walk inventory method to determine width-depth ratios. For Took Creek, both the most recent PIBO inventory (2019) and the I-walk survey results are listed.

Managed and unmanaged streams on the Bitterroot NF, and throughout the Northern Rockies, rarely possess a wetted width-depth ratio < 10 (Overton et al. 1995; Archer et al. 2006; 2016; Kershner and Roper, 2010; Archer and Ojala, 2017; 2018). It is not an effective metric for assessing the overall health of stream channels. A more informative metric is the bankfull width-depth ratio, as used by Rosgen (1999). In this BA/BE, the wetted width-depth ratio is reported because it is a default RMO contained in the INFISH amendment to the Forest Plan. The bankfull width-depth ratio is also reported if it is available. The PIBO methodology measures both metrics (USDA Forest Service, 2016).

Lower Blue Joint Creek (HUC 0106). Blue Joint Creek has a wetted width-depth ratio of 60 (Table 9), which does not meet the RMO. The wetted width-maximum depth ratio in scour pools is 11.6, which meets FAR criteria in the Baseline Matrix (USFWS, 1998a: pg 21). Channel dimensions are believed to be at or near reference conditions. Stream banks are functioning properly. Stream banks on B reaches are stable, rocky, and well vegetated; C reaches have more naturally unstable banks with cobble-dominated point bars. Stream banks along the small tributaries to Blue Joint Creek are stable and densely vegetated with riparian shrub cover. Tributary wetted width-maximum depth ratios in scour pools range between 4.8 and 8.8, which meet FA criteria in the Baseline Matrix (USFWS, 1998a: pg 21). In 2019, PIBO site #265

in Took Creek had a wetted width-depth ratio of 15.9 and a bankfull width-depth ratio of 7.3. The stream banks were estimated to be 100% stable with vegetation producing 90.5% of the stability. Undercut banks are uncommon. The bank angle index score in PIBO site #265 is low, just above the 10th percentile for managed sites on the Bitterroot NF and below the 10th percentile for reference sites (USDA Forest Service, 2020). GIS rates the *Wetted Width/Max Depth Ratio* and *Streambank Condition* indicators in HUC 0106 as FUR. The majority of the data supports upgrading both indicators to FAR.

Painted Rocks Lake (HUC 0108). There are no fish-bearing streams in the action area portion of HUC 0108. The only water bodies in the action area are Painted Rocks Reservoir and three non-fish bearing intermittent tributaries that drain into the reservoir from the west between Painted Rocks Dam and Blue Joint Bay. Channel dimensions were not measured in those intermittent streams.

Little West Fork (HUC 0203). Wetted width-depth ratios in HUC 0203 are 69 (Little West Fork), 78 (Soda Springs Creek), and 34 (Sentimental Creek), none of which are meeting the RMO (Table 9). Wetted width-maximum depth ratios in scour pools are 7.1 (Little West Fork), 7.7 (Soda Springs Creek), and 7.3 (Sentimental Creek), all of which meet FA criteria in the Baseline Matrix (USFWS, 1998a: pg 21). Channel dimensions are believed to be at or near reference conditions. Stream banks are functioning properly. Stream banks on A and B reaches are stable, rocky, and well vegetated; C reaches have more naturally unstable banks with cobble-dominated point bars. GIS rates the *Wetted Width/Max Depth Ratio* and *Streambank Condition* indicators in HUC 0203 as FA. This BA/BE proposes no changes to those indicators.

Nez Perce Fork (HUC 0204). The Nez Perce Fork has a wetted width-depth ratio of 57 (Table 9), which does not meet the RMO. The wetted width-maximum depth ratio in scour pools is 9.4, which meets FA criteria in the Baseline Matrix (USFWS, 1998a: pg 21). In some areas, channel dimensions are affected by the near-stream location of FR 468. In particular, about 0.5 miles of the north bank has been rip-rapped where FR 468 gets really close to the stream. Tributary wetted width-maximum depth ratios range between 5.9 and 7.8, which meet FA criteria in the Baseline Matrix (USFWS, 1998a: pg 21). Stream banks along the small tributaries to the Nez Perce Fork are generally stable and densely vegetated with riparian shrub cover; however, close encroachment of near-stream roads affects stream channel morphology and bank stability along portions of Two, Tough, and Flat creeks. GIS rates the *Wetted Width/Max Depth Ratio* and *Streambank Condition* indicators in HUC 0204 as FUR. This BA/BE proposes to upgrade the *Wetted Width/Max Depth Ratio* indicator to FAR and leave the *Streambank Condition* indicator as FUR.

West Fork Bitterroot River-Rombo Creek (HUC 0301). The HUC 0301 portion of the West Fork Bitterroot River has a wetted width-depth ratio of 64 (Table 9), which does not meet the RMO. The wetted width-maximum depth ratio in scour pools is 11.9, which meets FAR criteria in the Baseline Matrix (USFWS, 1998a: pg 21). About a dozen meander bends along the east bank are rip-rapped where the West Fork Highway gets close to the river. The river banks in HUC 0301 are rocky and stable, and channel dimensions are primarily controlled by water releases from Painted Rocks Dam, and to a lesser degree by highway encroachment. Tributary wetted width-maximum depth ratios range between 4.0 and 7.4, which meet FA criteria in the Baseline Matrix (USFWS, 1998a: pg 21). Stream banks along the small tributaries in HUC 0301 are generally stable and densely vegetated with riparian shrub cover; however, close encroachment of near-stream roads affects stream channel and bank stability along portions of Beavertail and Ditch creeks. GIS rates the *Wetted Width/Max Depth Ratio* indicator in HUC 0301 as FAR and the *Streambank Condition* indicator as FUR. This BA/BE proposes no changes to those indicators.

West Fork Bitterroot River-Lloyd Creek (HUC 0305). The HUC 0305 portion of the West Fork Bitterroot River has a wetted width-depth ratio of 83 (Table 9), which does not meet the RMO. The wetted width-maximum depth ratio in scour pools is 14.9, which meets FAR criteria (USFWS, 1998a: pg 21). About five long meander bends along the west bank are rip-rapped where the West Fork Highway gets close to the river. The river banks in HUC 0305 are rocky and stable, and channel dimensions are primarily controlled by water releases from Painted Rocks Dam, and to a lesser degree by highway encroachment. GIS rates the *Wetted Width/Max Depth Ratio* indicator in HUC 0305 as FAR, and the *Streambank Condition* indicator as FUR. This BA/BE proposes no changes to those indicators.

4.10.4 Water Temperature RMO

The action area portions of the West Fork Bitterroot River and the lower reaches of the Nez Perce Fork, Blue Joint Creek, and the Little West Fork are primarily migratory corridors that provide adult holding habitat, overwintering habitat, and juvenile rearing habitat. The RMO for those streams and reaches is no days with maximum temperatures higher than 59º F (15º C), and no measurable increase in the 7-day mean-maximum temperature over time.

The upper reaches of the Nez Perce Fork, Blue Joint Creek, Little West Fork, and the rest of the tributaries in the action area provide spawning and rearing habitat. The RMO for those streams and reaches is no days with maximum temperatures higher than 48º F (9º C), and no measurable increase in the 7-day mean-maximum temperature over time.

Cold water is a key factor related to the health and survival of native trout, especially bull trout. Bull trout are the most thermally intolerant fish species on the Bitterroot NF. Bull trout are most common in streams that rarely exceed 13º C and have a mean August temperature <11° C (Isaak et al. 2015). Westslope cutthroat trout are more tolerant of warmer water than bull trout, but are most common in streams that rarely exceed 15º C.

Water temperatures were monitored in nearly all of the fish-bearing streams in the Mud Creek action area in 2018 and 2019. Table 10 displays three temperature metrics (7-day mean-maximum; mean August temperature, and degree days) that were recorded at these sites in 2018 and 2019. None of the sites were able to meet their water temperature RMO.

Table 10. Water Temperature Metrics Recorded in the Mud Creek Fish-bearing Streams

Stream	RM[1]	RMO	2018 7-day MMax	2019 7-day MMax	2018 Mean Aug Temp	2019 Mean Aug Temp	2018 Degree Days	2019 Degree Days
West Fork	1.2	< 15º	18.8º	no data[3]	13.5º	no data[3]	986	no data[3]
West Fork	22.2	< 15º	15.5º	16.5º	10.9º	12.1º	864	937
Nez Perce	1.0	< 15º	18.0º	17.9º	13.3º	14.0º	881	933
Nez Perce	11.0	< 10º	14.8º	15.2º	11.0º	11.8º	727	784
Blue Joint	0.5	< 15º	18.4 º	19.1º	13.1 º	14.2 º	871	934
Blue Joint	5.9	< 15º	15.4º	16.1º	11.8º	12.8º	778	839
Little West Fork	0.1	< 15º	16.2º	16.4º	12.7º	13.3º	830	882
Soda Springs	0.1	< 10º	14.4º	14.4º	11.7º	12.3º	777	812
Nelson	0.1	< 10º	no data[4]	11.4º	no data[4]	9.8º	no data[4]	674
Beavertail	0.1	< 10º	14.1º	14.9º	10.9º	12.0º	717	797
Blue Joint trib 3.8	0.1	< 10º	13.8º	12.9º	10.9º	10.9º	720	733
Buck	0.5	< 10º	13.5º	14.4º	11.1º	12.0º	740	800
Cone	0.1	< 10º	11.9º	12.3º	9.4º	10.1º	619	680
Ditch	0.6	< 10º	no data[2]	no data[4]	no data[2]	no data[4]	no data[2]	no data[4]
Fales	0.1	< 10º	13.7º	13.7º	10.7º	11.2º	691	742
Flat	0.1	< 10º	12.6º	13.1º	10.4º	11.0º	687	738
Fork		< 10º	no data[4]	no data[4]	no data[4]	no data[4]	no data[4]	no data[4]
Line	0.1	< 10º	9.9º	10.3º	8.0º	8.7º	542	588
Magpie	0.1	< 10º	14.1º	14.1º	11.1º	11.7º	730	781
Mud	0.1	< 10º	14.4º	14.8º	11.2º	11.9º	737	798
Nez Perce trib 8.0	0.1	< 10º	12.7º	no data[3]	10.3º	no data[3]	682	no data[3]
Peyton	0.1	< 10º	no data[3]	13.5º	no data[3]	11.1º	no data[3]	746
Rombo	0.1	< 10º	11.2º	11.8º	9.1º	9.9º	609	670
Sand	0.1	< 10º	no data[3]	no data[3]	no data[3]	no data[3]	no data[3]	no data[3]
Sentimental	0.1	< 10º	no data[3]	12.3º	no data[3]	10.5º	no data[3]	704

Stream	RM[1]	RMO	2018 7-day MMax	2019 7-day MMax	2018 Mean Aug Temp	2019 Mean Aug Temp	2018 Degree Days	2019 Degree Days
Took	0.1	< 10º	14.8º	14.8º	11.5º	11.7º	760	790
Tough	0.1	< 10º	12.6º	13.0º	10.0º	10.7º	649	712
Two	0.2	< 10º	14.4º	14.1º	11.4º	12.0º	760	812

[1]RM = River mile. The distance in miles upstream from the mouth of the stream where temperatures were recorded.
[2]no data = data is not available because stream flows went dry during the monitoring period.
[3]no data = data is not available because the thermograph malfunctioned or was lost.
[4]no data = data is not available because the site was not monitored.

Lower Blue Joint Creek (HUC 0106). Temperatures were monitored in Blue Joint Creek near its mouth (RM 0.5), and at the Blue Joint trailhead (RM 5.9). RM 0.5 is near the downstream end of HUC 0106; RM 5.9 is at the upstream end. Neither site was able to meet its RMO in 2018 and 2019 (Table 10). 7-day mean-maximums ranged between 18.4° and 19.1º C at RM 0.5, and between 15.4° and 16.1º C at RM 5.9 (Table 10). Maximum temperatures were 3° C warmer at RM 0.5 than at RM 5.9, and August temperatures may be too warm for bull trout at RM 0.5. Took Creek, Magpie Creek, and Blue Joint trib 3.8 (small fish-bearing tributaries to Blue Joint Creek) had 7-day mean-maximums ranging between 12.9° and 14.8° C (Table 10). These temperatures exceed the RMO and are warmer than reference sites. Data is not available for Sand and Fork creeks, two other small tributaries to Blue Joint Creek. The NorWeST Model (Isaak et al. 2017; https://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html) predicts that the mean August temperature in those streams likely ranges between 8° C and 10° C. In that range, the 7-day mean-maximum usually exceeds 10° C. GIS rates the *Temperature* indicator in HUC 0106 as FAR. For the most part, the data supports this rating.

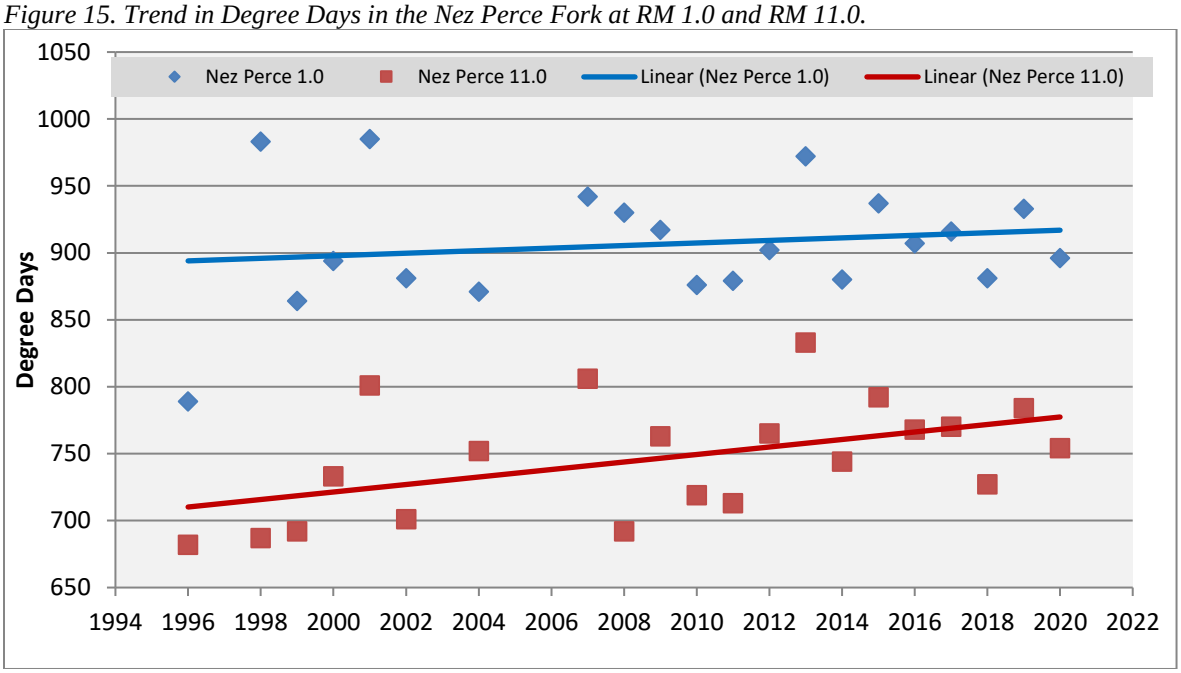
Painted Rocks Lake (HUC 0108). There are no fish-bearing streams in the action area portion of HUC 0108. The only water bodies in the action area are Painted Rocks Reservoir and three non-fish bearing intermittent tributaries that drain into the reservoir from the west between Painted Rocks Dam and Blue Joint Bay. Temperatures were not monitored in the reservoir or those intermittent streams.

Little West Fork (HUC 0203). Temperatures were monitored near the mouths of the Little West Fork (RM 0.1), Soda Springs Creek (RM 0.1) and Sentimental Creek (RM 0.1). 7-day mean-maximums ranged between 16.2° and 16.4º C in the Little West Fork (Table 10). In Soda Springs and Sentimental creeks, the 7-day mean-maximums were 14.4° C and 12.3º C, respectively (Table 10). None of the sites were able to meet their RMOs in 2018 and 2019. Although temperatures in the Little West Fork are relatively warm, its watershed contains a high percentage (80%) of wilderness and inventoried roadless lands. As a result, the temperature regime is largely controlled by natural processes with man's activities having a negligible impact. The Little West Fork also contains some low gradient reaches that have naturally high solar exposure. There are a few road stream crossings in the lower 1/3rd of the HUC, but they cross at perpendicular angles and are not located in the RHCAs for significant lengths. GIS rates the *Temperature* indicator in HUC 0106 as FAR. For the most part, the data supports this rating.

Nez Perce Fork (HUC 0204). Since the mid 1990's, temperatures have been annually monitored in the Nez Perce Fork at RM 1.0 (near Nelson Creek) and RM 11.0 (near the Fales Flat campground) (Figure 15). Thermograph data indicates that 7-day mean-maximums at stream mile 1.0 are in the 17.5° to 19° C range, while those at stream mile 11.0 are in the 14.5° to 16° C range. Neither site is able to meet its RMO. The trend at both sites has been increasing (Figure 15). August temperatures are still suitable for bull trout at RM 11.0, but may be too warm for bull trout at RM 1.0. None of the small, fish-bearing tributaries to the Nez Perce Fork are meeting their RMOs for water temperature (Table 10). However, temperatures in Nelson, Cone, Peyton, Fales, and unnamed tributary 8.0 appear to be in natural condition; temperatures in Tough and Flat creeks appear to be slightly warmer than natural condition. Two Creek is the one tributary that appears to be considerably warmer than natural condition. Two Creek only connects to the Nez Perce Fork at high flows and contributes a tiny fraction of the Nez Perce's discharge. GIS rates the *Temperature* indicator in HUC 0204 as FAR. The data supports downgrading this rating to FUR.

Temperatures in the Nez Perce Fork show an increasing trend at the RM 1.0 and RM 11.0 monitoring sites (Figure 15). Overall, it appears that in the present climate, even during the coldest summers, the Nez Perce Fork is incapable of meeting its RMOs and water quality goals.

Figure 15. Trend in Degree Days in the Nez Perce Fork at RM 1.0 and RM 11.0.



West Fork Bitterroot River (HUCs 0301 and 0305). Summer and autumn temperatures in the HUC 0301 and 0305 portions of the West Fork Bitterroot River are predominantly influenced by water releases from Painted Rocks Dam. The Montana DNRC releases water (leased by Montana Fish, Wildlife, and Parks) from the Painted Rocks Reservoir from July through September to primarily augment instream flows in the Bitterroot River. A lesser amount of the released water is used for irrigation. When water is initially released from the reservoir (in most years, releases start around mid-July), river temperatures in HUCs 0301 and 0305 immediately cool for a couple of weeks and then gradually warm up again in August and September as the hyoplimnetic water in the reservoir is depleted and the warmer surface waters are passed downstream. In some years, the maximum annual river temperatures in HUCs 0301 and 0305 occur in the month of July prior to the start of water releases. In other years, maximum river temperatures have occurred in the latter part of August when temperatures in the unregulated streams are starting to cool.

There are two water temperature monitoring stations on the West Fork Bitterroot River that are located within or downstream of the action area. Temperatures are recorded at these stations every summer (July through September). The lowest downstream monitoring station is located at RM 1.2, which is near Conner, MT at the lower end of HUC 0305. Mean-maximum temperatures at RM 1.2 typically range between 18° and 21º C, and exceed the < 15º C RMO in every summer. There is also a monitoring station at RM 22.2, which is located a short distance downstream from Painted Rocks Dam (HUC 0301). Mean-maximum temperatures at RM 22.2 typically range between 15° and 17º C, and exceed the < 15º C RMO during most summers. In summer, temperatures in the river immediately below Painted Rocks Dam are about 3º C colder than those at Conner.

The Bitterroot Headwaters TMDL (MDEQ, 2005) established a goal of a mean-maximum temperature < 15° C at RM 1.2 and RM 22.2. This goal is never met at RM 1.2, and not met in most years at RM 22.2. Over the past couple of decades, mean-maximum temperatures have ranged between 18° and 21°C at RM 1.2 and 15° and 17°C at RM 22.2. The mean-maximums have not varied much between years despite considerable differences in summer air temperatures, which shows that water releases from Painted Rocks

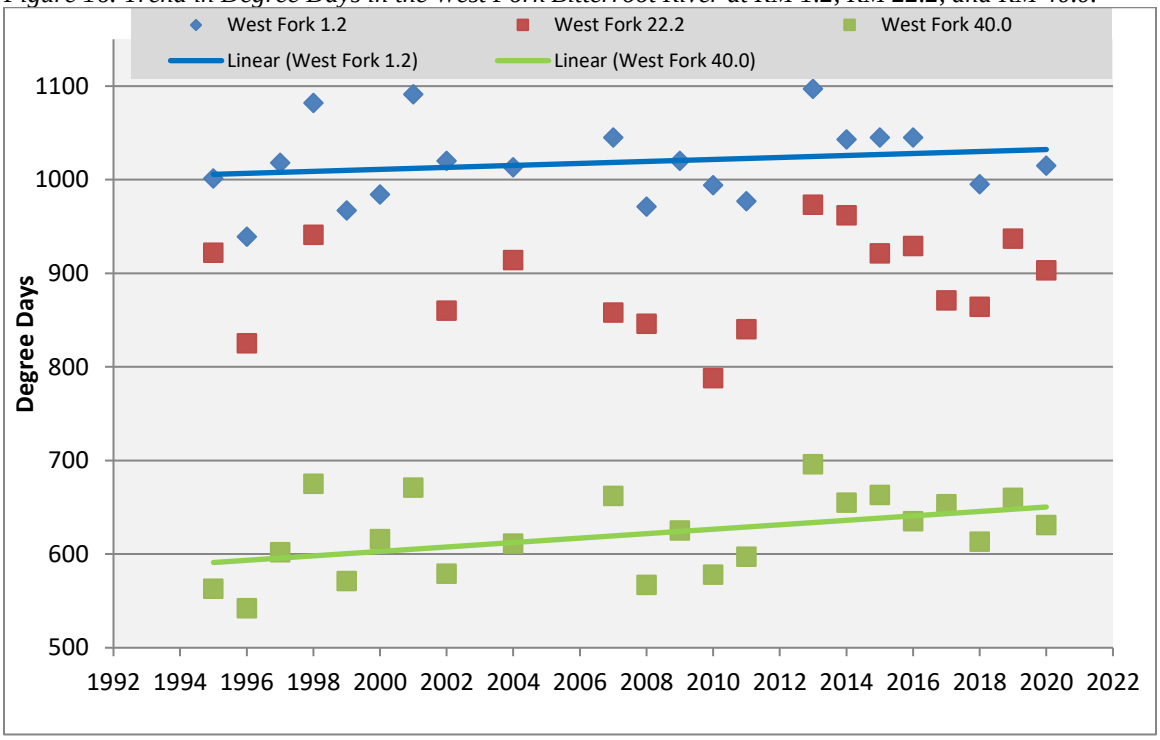
Reservoir play a larger role in dictating river temperatures than summer air temperatures. The 45% effective shade goal established in the Bitterroot Headwaters TMDL is also not being met in the HUC 0301 and 0305 portions of the West Fork Bitterroot River.

With the exception of Rombo and Line creeks, the small fish-bearing tributaries in HUC 0301 (Beavertail, Buck, Ditch, and Mud creeks) contain water temperatures that are warmer than reference sites. Line Creek and Rombo Creek are the coldest fish-bearing tributaries in HUC 0301, but neither stream was able to meet its RMO.

GIS rates the *Temperature* indicator in HUC 0301 as FAR and the *Temperature* indicator in HUC 0305 as FUR. This BA/BE proposes no changes to those indicators.

Temperatures in the West Fork Bitterroot River show an increasing trend at all three of its monitoring sites since long-term monitoring started in 1994 (Figure 16). The steepest increase has occurred at RM 40.0 in the headwaters where much of the area was burned by the Saddle Complex (2011) and Mustang Complex (2012) fires. There has been less of an increase at RMs 1.2 and 22.2. Overall, it appears that in the present climate, even during the coldest summers, the West Fork is incapable of meeting its RMOs and water quality goals.

Figure 16. Trend in Degree Days in the West Fork Bitterroot River at RM 1.2, RM 22.2, and RM 40.0.



The bull trout local populations in the Mud Creek action area are considered to be highly vulnerable to climate change. In the Bull Trout Conservation Strategy (USDA Forest Service, 2013), the following climate change vulnerability ratings were made: High (Blue Joint Creek local population, pg 212); and High (Nez Perce Fork local population, pg 247). The Lower West Fork Bitterroot River local population was not discussed in the Bull Trout Conservation Strategy, but its vulnerability rating is also high.

Consistent with the ratings in the Bull Trout Conservation Strategy are the predictions made by the NorWest Model (Isaak et al. 2017; https://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html). By 2040, the NorWest Model makes the following predictions for stream temperatures in the Mud Creek action area (brace yourself – they are bleak):

- The action area portions of the West Fork Bitterroot River will be too warm to support juvenile bull trout.
- The action area portions of Blue Joint Creek will be too warm to support juvenile bull trout. Suitable cold water (> 90% probability) will still persist in the upper reaches of Blue Joint Creek above Jack-the-Ripper Creek.
- All of the Nez Perce Fork will be too warm to support juvenile bull trout.
- Sentimental Creek will have < 25% probability of containing cold enough water to support juvenile bull trout.
- The upper reaches of the Little West Fork and Soda Springs Creek will have < 25% probability of containing cold enough water to support juvenile bull trout.
- Nelson Creek will have > 25% probability but < 50% probability of containing cold enough water to support juvenile bull trout.
- Rombo Creek will have > 25% probability but < 50% probability of containing cold enough water to support juvenile bull trout.
- Any streams not mentioned above will be too warm to support juvenile bull trout.

To summarize, the trends in the local monitoring data (Table 10; Figures 15 and 16) and the information in the Bull Trout Conservation Strategy (USDA Forest Service, 2013) are supportive of the NorWest Model (Isaak et al. 2017) predictions that by 2040, there may be very little suitable habitat remaining for juvenile bull trout in the Mud Creek action area.

4.11 Sediment

INFISH did not establish an RMO for sediment. However, because it is such an important habitat feature for streams on the Bitterroot NF and particularly for bull trout (Rieman and McIntyre, 1993), this BA/BE essentially treats sediment as an RMO and a discussion of sediment conditions is included in this section. This analysis defines sediment as any stream bottom particles < 2 mm in diameter, the size class that consists of sands and silts.

Increased sediment loads alter a stream's natural biotic community (algae, macrophytes, invertebrates, and fishes), and have been shown to be a major factor in the habitat loss for mussels (Stagliano, 2010). Sediment fills in the interstitial spaces between the rocks in the stream bottom, which greatly influences the diversity and abundance of aquatic insects, particularly those species that rely on filter feeding and algal grazing. Sediment affects trout directly by smothering/burying their redds, which reduces oxygen supply to the eggs and the number of eggs that eventually hatch to fry. This is known as entombment. The number of eggs that survive to fry is strongly affected by the amount of sediment in the stream bottom (Bjornn and Reiser, 1991; Chapman, 1988; Everest et al. 1987). As sediment goes up, egg survivorship goes down. Juvenile trout, particularly bottom-dwelling species like bull trout, also need clean hiding spaces between the rocks in the stream bottom to survive and grow. The more sediment that fills the spaces, the less hiding cover for trout, which leads to poorer juvenile survivorship. Sediment also reduces juvenile trout survivorship indirectly by altering aquatic insect composition (the main food source for juvenile trout), thereby decreasing the abundance of prey.

Forest roads are the main source of anthropogenic sediment in the action area. There is a consistent relationship in the scientific literature between roads and the amount of fine sediment in streams (see authors cited in Quigley and Arbelbide, 1997: pgs 1102, 1253, and 1345). In general, the more roads in a watershed; the more sediment in its streams. As evidenced by the numbers in Table 11, the majority of the Mud Creek action area is heavily roaded. Table 11 displays road metrics for the portions of the 6th level HUCs that lie within the Mud Creek action area.

*Table 11. Road Metrics for the Portions of the 6th level HUCs in the Mud Creek Action Area **

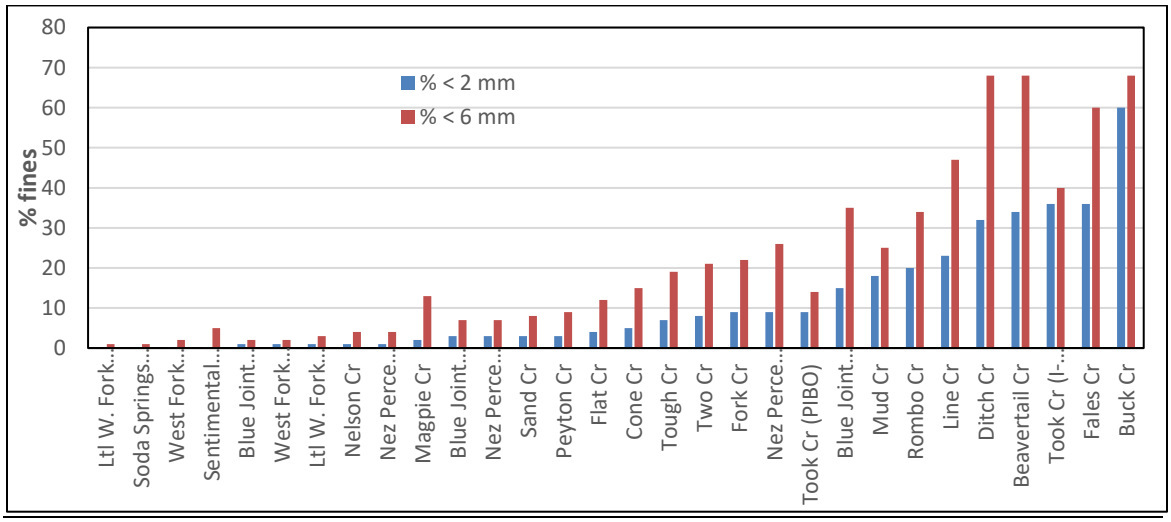
6th HUC	Total miles of road (includes stored roads)	Miles in RHCAs	Road Density (miles/mile²)	# Road Stream Crossings	% of perennial stream length < 300 feet from roads
0106 (Lower Blue Joint)	148.1	13.8	11.7	128	43
0108 (Painted Rocks Lake-WF Bitt River)	3.7	0.3	3.7	3	0
0203 (Little West Fork)	16.1	2.8	4.6	20	36
0204 (Nez Perce Fork)	117.0	26.1	4.5	109	40
0301 (Rombo Cr-WF Bitt River)	186.5	17.3	6.5	149	39
0305 (Lloyd Cr-WF Bitt River)	7.5	1.6	2.5	9	52

* The numbers in Table 11 are from a GIS query conducted on the Bitterroot National Forest in February 2020. They differ from the numbers reported in the November 2017 update of the bull trout watershed baseline. The watershed baseline numbers include all of the roads in the 6th level HUC; the numbers in Table 11 only include the roads within the action area – not necessarily the entire HUC.

Forest roads are an example of a "press" disturbance, meaning that sediment is contributed to streams from the road system indefinitely throughout time whenever storm and runoff events occur. The most negative aspect of the press disturbance is that it never goes away. In addition to the chronic sediment delivery that occurs from roads, "pulse" disturbance events in the form of wildfires have also delivered large, one time inputs of sediment to streams in portions of the action area. For example, during the first 1-3 years after the 2000 fires andthe 2007 Rombo fire, post-fire erosional events contributed large amounts of sediment to Blue Joint Creek and its tributaries following the 2000 fires, and Rombo Creek following the 2007 Rombo fire. Current erosion rates from the burned areas have now diminished to pre-fire levels and much of the sediment that was contributed to streams has been transported out of the system. However, some of the sediment that was delivered by the fires is still being stored in the bottoms of pools and low velocity habitat types. These deposits likely are transported downstream only during very high flows, and it may take several decades to clean them out entirely. The fires and post-fire erosional events are examples of pulse disturbances. In pulse disturbances, large inputs occur all at once in a big gulp, but then are routed out of the system over the next few decades and are not replaced until the next large disturbance occurs.

Figure 17 displays the percent surface fines < 2 mm and < 6 mm that were measured in pool tail crest habitats in the action area streams using the PIBO methodology (USDA Forest Service, 2016). Sediment data was collected in 2019 in all of the fish-bearing streams in the action area except Fork Creek. Fork Creek was sampled for sediment in 2020.

Figure 17. Percent Surface Fines < 2 mm and < 6 mm in the Mud Creek Action Area



Excess accumulations of sediment are a concern in about a third of the streams in the Mud Creek action area. The highest levels generally occur in the small tributaries to the West Fork in HUC 0301 (Beavertail, Buck, Ditch, Rombo, Line, Mud) (Figure 17). Those watersheds contain high road densities in highly erosive granitic geology. High sediment levels can also occur naturally, such as in Fales Creek (Figure 17), a small tributary to the Nez Perce Fork that is located in the Blue Joint Wilderness Study Area.

Lower Blue Joint Creek (HUC 0106). Blue Joint Creek is a relatively clean, cobble/boulder stream with low amounts of sediment. The 2019 sediment surveys using the PIBO methodology measured surface fines at 3% < 2 mm and 7% < 6 mm in a lower reach of Blue Joint Creek, and 1% < 2 mm and 2% < 6 mm in an upper reach below the Blue Joint trailhead (Figure 17). The primary sources of anthropogenic sediment come from the small tributaries that drain the heavily roaded watersheds on the north side of Blue Joint Creek (Took, Magpie, trib 3.8, and Sand creeks). The combined sediment input from these tributaries is tiny compared to the natural background sediment load of Blue Joint Creek. FR 362 is located in the valley bottom on the north side of Blue Joint Creek, but only about 550 feet of the road is located within 100 feet of the stream, and over the majority of its length there is good vegetative filter between the road and stream. Also, the grade of FR 362 is relatively flat (1-2%) and most of its segments are graveled. For these reasons, FR 362 is not a major sediment source. In Took Creek PIBO site #265, the median substrate index score is at the 50th percentile of managed sites on the Bitterroot NF and below the 25th percentile of reference sites (USDA Forest Service, 2020). The pool fines index score is just below the 90th percentile of managed sites on the Bitterroot NF and near the 75th percentile of reference sites (USDA Forest Service, 2020). Overall, the sediment numbers for Blue Joint Creek meet FA criteria, but the presence of heavily roaded tributary drainages (Took, Magpie, trib 3.8, and Sand creeks) increases risk somewhat, so the FAR rating is most appropriate. Despite the high road density in the HUC, sediment does not appear to be a limiting factor for bull trout habitat quality in HUC 0106 (USDA Forest Service, 2013: pgs 212-214). GIS rates the *Sediment* and *Substrate Embeddedness* indicators in HUC 0106 as FUR. This BA/BE proposes to upgrade both indicators to FAR, based on the field data.

Painted Rocks Lake (HUC 0108). There are no fish-bearing streams in the action area portion of HUC 0108. The only water bodies in the action area are Painted Rocks Reservoir and three non-fish bearing intermittent tributaries that drain into the reservoir from the west between Painted Rocks Dam and Blue Joint Bay. Sediment was not measured in those intermittent streams.

Little West Fork (HUC 0203). The Little West Fork and its fish-bearing tributaries (Soda Springs, Sentimental) contain very low amounts of sediment (0.01 to 1% < 2 mm; 1-5% < 6 mm) (Figure 17). The sediment regime is largely controlled by natural processes, and roads are delivering insignificant amounts of sediment to streams (USDA Forest Service, 2013: pg 251). GIS rates the *Sediment* and *Substrate Embeddedness* indicators in HUC 0203 as FAR. The field data indicates that these ratings could be upgraded to FA. However, because 36% of the perennial stream length in the action area portion of the HUC is located within 300 feet of roads (Table 11), this BA/BE proposes to keep the ratings at FAR.

Nez Perce Fork (HUC 0204). The Nez Perce Fork contains a cobble/boulder dominated stream bottom. The 2019 sediment surveys using the PIBO methodology measured surface fines at 1% < 2 mm and 4% < 6 mm in a lower reach below the FR 732 bridge, and 9% < 2 mm and 26% < 6 mm in an upper reach between Watchtower and Peyton creeks (Figure 17). These numbers are not excessively high; however, because of the close proximity of FR 468 (2.1 miles are located within 100 feet of the Nez Perce Fork, and often within 30 feet of the stream), increased delivery of road sediment is occurring and there is always higher risk during storm events. On the positive side, the grade of FR 468 is relatively flat (1-2%) and the near-stream segments are graveled, both of which help to reduce its sediment delivery potential. The small, non-bull trout tributaries to the Nez Perce Fork (Two, Tough, Flat, Peyton, Fales, Cone, Nez Perce trib 8.0) have surface fine levels ranging between 3-36% < 2 mm and 9-60% < 6 mm (Figure 17). Fales Creek, located in the Blue Joint Wilderness Study Area, has the highest levels (Figure 17). The Bull Trout Conservation Strategy gave the *Sediment* indicator in HUC 0204 a rating of FUR, with a professional judgement rating of FAR (USDA Forest Service, 2013: pgs 251-252). Although the sediment numbers measured in 2019 could justify a FAR rating, the near-stream location of FR 468 increases risk and puts the

Sediment and *Substrate Embeddedness* indicators in the FUR category. This BA/BE proposes to keep the ratings for both indicators at FUR.

West Fork Bitterroot River (HUCs 0301 and 0305). In the Bitterroot Headwaters TMDL (MDEQ, 2005), DEQ designated the West Fork Bitterroot River as a sediment impaired stream. The TMDL designation included the entire river, but the reason for the impairment differs above the dam versus below. Above the dam, aggradation of sediment is the primary reason for impairment. Below the dam, however, degradation of sediment (i.e. a shortage of fine substrates) is the primary reason for impairment. The Bitterroot Headwaters TMDL states, "…sediment targets in the lower river suggest a possible coarsening of the stream substrate limiting fine sediment deposition, probably as a result of the sediment capture by Painted Rocks Dam" (MDEQ, 2005: section 3.0, pg 127).

The HUC 0301 and 0305 portions of the West Fork Bitterroot River are located downstream of Painted Rocks Dam and Painted Rocks Reservoir. The reservoir acts as a large sediment trap. As a result, over the past 80 years the portion of the West Fork between the dam and the Nez Perce Fork confluence has changed from a braided, highly sinuous channel to a more simplified, armored, and less sinuous one. Numerous gravel bars and channel braids evident in 1954 aerial photos are now vegetated and no longer apparent in the aerial imagery. The result is a simplified river channel with a sediment-starved substrate dominated by boulders and cobbles with low amounts of gravels and fines. The data collected in 2019 is supportive of the sediment-starved condition (Figure 17).

The Bitterroot Headwaters TMDL established a sediment TMDL and water quality goals for the West Fork Bitterroot River. The TMDL is a 57% reduction in sediment delivered by forest roads and a 75% reduction in sediment delivered by human-caused bank erosion (MDEQ, 2005: pgs 181-182). Water quality goals were established for riffle habitats in C4 reaches above or below Painted Rocks Dam. The water quality goals are:

- Percent surface fines < 2 mm: mean = 23%; range = 14-32%
- Percent surface fines < 6 mm: mean = 33%; range = 17-49%
- d50: Range between 3 to 47 mm
- Clinger Richness: > 14

The HUC 0301 and 0305 portions of the West Fork contain river bottoms that are cleaner (i.e. have less fines) than the TMDL water quality goals. Fines were measured with grid tosses in 2019 in both the HUC 0301 and 0305 portions of the West Fork. In HUC 0301, percent surface fines < 2 mm and < 6 mm averaged 0.2% and 2% (Figure 17). In the action area portion of HUC 0305, percent surface fines < 2 mm and < 6 mm averaged 1% and 2% (Figure 17). Further downstream in HUC 0305 near the mouths of Violet and Piquett creeks, percent surface fines < 2 mm and < 6 mm averaged 1-5% and 3-7%. The d50 particle size and Clinger Richness (an estimate of macroinvertebrate diversity) were not measured in 2019.

Other than the West Fork Bitterroot River, Rombo Creek is the only other bull trout stream in the action area portions of HUCs 0301 and 0305. Rombo Creek contains a small bull trout population that is isolated in about 2.5 miles of its middle reaches. The 2019 sediment surveys using the PIBO methodology measured surface fines at 20% < 2 mm and 34% < 6 mm in Rombo Creek (Figure 17). These levels are elevated, and forest roads and the 2007 Rombo fire are believed to be the main sources of sediment.

GIS rates the *Sediment* and *Substrate Embeddedness* indicators in HUC 0301 as FUR, and in HUC 0305 as FAR. This BA/BE proposes to upgrade the indicators to FAR in HUC 0301, and make no changes to the indicators in HUC 0305.

5. Direct, Indirect, and Cumulative Effects

5.1 Spatial and Temporal Bounds of the Analysis

The spatial boundary of this effects analysis is the action area, which is described in Section 2.

As for the temporal boundaries, the direct and indirect effects described in this BA/BE would start at implementation of a sediment-producing activity and continue for the first three years after that activity has been completed. In the case of beneficial projects such as removing roads and culverts, the benefits to aquatic species gained from those types of activities would continue indefinitely into the future. In this BA/BE, "short-term" refers to effects that would be limited to the first three years after implementation of an activity has been completed. "Long-term" refers to effects that would commence three years after implementation of an activity is completed and would continue for at least a decade or longer.

The time frame during which potential cumulative effects would occur would be during implementation of a sediment-producing activity and for the first three years after implementation has been completed. For herbicide applications, it would be the first year after herbicides have been applied. After those periods, there would be no sediment or herbicide effects occurring in the project area that could potentially overlap in space and time with other activities to create to cumulative effects.

5.2 Effects Analysis Framework

Potential effects to five habitat features are analyzed in this BA/BE. Those features are:

1. Sediment
2. Water temperature
3. Water chemistry
4. Woody debris recruitment
5. Migration barriers

The habitat features listed above incorporate "the four C's" of good bull trout habitat: (1) Cold (water temperature); (2) Clean (sediment and water chemistry); (3) Complex (woody debris recruitment); and (4) Connected (migration barriers).

5.2.1 Sediment

The activities in the Proposed Federal Action would create soil disturbance in portions of the action area. Precipitation on the areas of soil disturbance would result in movement (erosion) of eroded soil particles, thus producing sediment. The sediment producing activities in the Proposed Federal Action include:

1. Timber harvest activities (felling, skidding, yarding, and log landings)
2. New construction of roads and trails (all types, permanent or temporary)
3. Log hauling
4. Treatments on existing roads (reconditioning, reconstruction, decommissioning, storage)
5. Prescribed burning

These activities were identified based on monitoring observations of past timber sales, prescribed burns, and road-related actions (documented in the Item 22 chapters of USDA Forest Service, 2002 through 2014-15 and USDA Forest Service, 2019a: AQT-03; also see Project File document AQUATICS-005), the direction and design criteria in the 2015 Road-Related Activities Biological Opinion (USFWS, 2015b), and the findings of Foltz et al. (2007a, 2007b).

Although all of the activities listed above would produce sediment, not all of them would be able to deliver their sediment into streams and potentially into fish habitat. This is because of the protection afforded by the design features (see Appendix B), particularly the preservation of RHCA buffers. A substantial body of scientific literature (Belt et al. 1992; USDA Forest Service, 2017; Roper et al. 2019) as well as project monitoring carried out by the Bitterroot NF (Item 22 chapters in USDA Forest Service, 2002 through 2014-15 and USDA Forest Service, 2019a: AQT-03) and the PIBO effectiveness monitoring program (USDA

Forest Service, 2020) supports the effectiveness of RHCAs in preventing sediment introduction from adjacent ground disturbance activities as well as protecting the riparian vegetation that creates desirable habitat conditions for aquatic species. A detailed summary of the RHCA literature, monitoring data, and conclusions is described in USDA Forest Service (2017) and Project File document AQUATICS-003.

A critical assumption in this effects analysis is that the project design features (Appendix B) will be properly implemented and are effective. Project File document AQUATICS-005 lists the Bitterroot NF projects where the effectiveness of the design features has been monitored and documented.

5.2.1.1 Timber Harvest Activities (felling, skidding, yarding, and log landings)

This category includes activities that occur within (felling, skidding, yarding) or adjacent to (log landings) timber harvest units. Tractor skid trails, skyline corridors, and log landings are potential sediment sources because they remove vegetation, expose bare soil to precipitation, and increase soil erosion. The steeper the slope the soil disturbance occurs on, the higher the potential for erosion and off-site movement of sediment.

Most of the scientific literature reviewing forestry-related stream sedimentation indicates that roads are the predominant source of sediment in streams, not yarding or log landings (Megahan, 1972; Schnackenburg and McDonald, 1998; Luce and Black, 2001a and 2001b; Jordan, 2006). Several studies (Belt et al. 1992; Davies and Nelson, 1994) found that erosion from logging units rather than roads could contribute sediment in certain situations, but most of the documented stream impacts occurred in clearcut units with steep side slopes and narrow or no buffer strips, or sediment transported from channelized sources such as intermittent streams. The units in the Proposed Federal Action are not located in those kinds of high risk delivery areas.

In the Proposed Federal Action, felling of commercial-sized trees, skidding, and yarding would be prohibited in the RHCAs with the exception of three small areas where a limited amount (about 19 acres) of commercial harvest would be allowed. Appendix A, attached to the back of this BA/BE, contains a site-specific Watershed Analysis that analyzes these three areas and their proposed activities in detail. Throughout the action area, log landings would generally be located outside of RHCAs; however, exceptions may be granted for previously used landings or natural openings that are located within RHCAs as long as those potential landing sites are field reviewed and approved by the fisheries biologist or hydrologist before they are used. Ground-based harvesting equipment would be prohibited from entering the RHCAs without prior approval of the fisheries biologist or hydrologist.

The buffer width of the RHCAs adjacent to the timber harvest units would range from 100 feet on intermittent streams (the narrowest), to 300 feet on fish-bearing streams (the widest). Appendix D contains a map of the RHCAs in the action area. Monitoring has shown that restricting tractor skid trails, skyline corridors, and log landings to areas outside of RHCAs is effective in preventing sediment from being able to infiltrate RHCAs and enter streams. This monitoring is documented in the Item 22 chapters in USDA Forest Service (2002) through USDA Forest Service (2014-15), and the AQT-03 monitoring item in USDA Forest Service (2019a). Additional monitoring of RHCA effectiveness is documented in USDA Forest Service (2017) and Project File documents AQUATICS-003 and AQUATICS-005. Since 2000, nearly 300 harvest units that contained RHCAs on the Bitterroot NF have been checked for sediment intrusion in the year following completion of the harvest, and in some cases, two years following harvest. In no instances was sediment observed leaving the harvest units or landings, filtering its way through the RHCA buffers, and entering streams.

The conclusion of this BA/BE is that the RHCA buffers would prevent the timber harvest activities from being able to deliver sediment to streams. Although some soil erosion and sediment production would occur within the boundaries of the harvest units, the sediment produced would not be able to exit the units in visible or measurable quantities, pass through the RHCA buffers that border the units, and enter streams.

5.2.1.2 New Construction of Roads and Trails (all types, permanent and temporary)

This category includes the construction of new Forest Service specified roads (i.e. permanent system roads), temporary roads, tracked line machine (TLM) trails, and new motorized trails.

New specified roads

A maximum of 9.76 miles of specified road construction is proposed to access timber harvest. Not all of this road mileage may be constructed; however, for the sake of analyzing potential effects, this BA/BE assumes that all of the miles will be constructed.

The Little West Fork (HUC 0203), Nez Perce (HUC 0204), and Lower Blue Joint (HUC 0106) 6th level HUCs are bull trout priority watersheds (USDA Forest Service, 2013: pgs 210-214, 246-252). No roads of any type would be constructed in the RHCAs in those watersheds. Because of this avoidance of RHCAs, the road construction that occurs in the bull trout priority watersheds is unlikely to deliver any meaningful quantities of sediment to streams.

In the rest of the project area, specified road construction would occur outside of RHCAs with the exception of four new road stream crossings (culverts) that would be constructed on upper Ditch Creek, two unnamed tributaries to Ditch Creek, and an unnamed tributary to Mud Creek. All of these new crossings would be located on non-fish bearing, intermittent, and small perennial streams in non-bull trout drainages. The Ditch Creek and Mud Creek watersheds do not contain bull trout or suitable bull trout habitat due to their small channel sizes and minimal flows. The specified road construction and new stream crossings that occur in those watersheds would have no effect on bull trout or bull trout habitat.

Temporary roads and TLM trails

A maximum of 32.79 miles of temporary road construction (including TLM trails) is proposed to access timber harvest. As with the specified roads, it is possible that not all of the miles would be constructed; however, this BA/BE assumes that it will.

All of the temporary roads that would be built (including TLM trails) would be located outside of RHCAs. In a few instances where road prisms already exist in RHCAs (e.g. undetermined roads), and there are culverts at the stream crossings, those prisms could be used as temporary roads as long as dirt is not side-casted within the RHCA. With these design features, temporary roads and TLM trails are unlikely to deliver any meaningful amounts of sediment to streams. Temporary roads and TLM trails are generally constructed near ridgelines and upper slopes and usually do not come close to RHCAs.

Temporary roads are likely to be present on the landscape for 1-3 years before they are recontoured and seeded. The ground-disturbing footprint of TLM trails is similar to that of temporary roads, but TLM trails are usually present on the landscape for a shorter period of time (a few months) before being recontoured and seeded.

Over the past 15 years, Forest fisheries biologists and hydrologists have monitored temporary roads and TLM trails in the following timber sales:

- Burned Area Recovery (USDA Forest Service, 2006: pg 82);
- Frazier Interface (USDA Forest Service, 2006: pg 76);
- Painted Rocks West (USDA Forest Service, 2007: pg 95);
- Lower West Fork (USDA Forest Service, 2010-13: pg 139);
- Lost Trail Ski Area Salvage Sale (USDA Forest Service, 2010-13: pg 142; USDA Forest Service,2014-15: pg 63); and
- Meadow Vapor (Jakober unit log, 2020).

In the timber sales listed above, all of the temporary roads and TLM trails stayed out of RHCAs and were recontoured after their use. Most were present on the landscape for < 1 year before being recontoured. Monitoring conducted prior to recontouring indicated that in the steeper pitches, eroded soils left the road surface via rill flow paths and typically moved downhill for 10-40 feet before being stopped by vegetation and slash. The majority of rill flow paths traveled < 20 feet from the edge of the road. Monitoring conducted after recontouring indicated that sediment did not travel more than a couple of feet beyond the shoulders of the roads and trails before it was stopped by vegetation and slash. In no instance was sediment seen entering an RHCA.

Trail construction

The Proposed Federal Action proposes to construct about three miles of new motorized trails in the action area. Most of the new trails would be 50-inch tread (ATVs); a lesser amount would be 72-inch tread

(UTVs). The trail segments would connect existing roads to give motorized users more loop riding opportunities. The trails would be located predominantly on ridges. They would avoid RHCAs and other areas where sediment could potentially be delivered to stream channels, wetlands or other water features.

A potential indirect effect of creating more loop riding opportunities is increased OHV traffic on the area's roads and trails. Right now, the Mud Creek area receives light OHV use and is not a popular destination for motorized users. The concern is that if motorized use increases in future years, it will increase erosion on the trails and potentially deliver more sediment to streams, some of which may eventually get transported downstream into bull trout habitat.

There are several reasons why this is unlikely to occur. First, it is questionable if the Mud Creek area ever will become a popular destination for motorized users. There are numerous other riding opportunities that already exist in the nearby Painted Rocks and upper West Fork areas, and the number and mileage of trails in those areas does a good job of dispersing motorized use. Also, the majority of the trail mileage in the Mud Creek area consists of closed logging roads, which are less attractive for many OHV riders than actual trails that lead to destinations. Finally, the OHV trails in the Mud Creek area do not cross many streams, and where they do cross streams, the crossings generally consist of stable, vegetated road crossings with culverts (i.e sites with minimal potential to deliver sediment). Hardened fords are present in a few locations on closed roads where culverts have been removed. The stream channels with fords are small, non-fish bearing, often intermittent, and with minimal potential to transport sediment far enough downstream to impact bull trout habitat, which is located at distances > 0.5 miles downstream of the fords. For those reasons, even in the unlikely event that the trail system was to receive substantial increases in OHV traffic, the increased use would still have a low risk of negatively affecting downstream bull trout habitat.

The conclusion of this BA/BE is that because of the avoidance of RHCAs, the construction of new specified roads, temporary roads, TLM trails, and motorized trails would deliver insignificant quantities of sediment to streams, and is likely to have no effect, and at worst an insignificant effect, on bull trout and bull trout habitat.

5.2.1.3 Log Hauling

Forest roads are commonly recognized as the primary source of human-caused sediment that accumulates in streams (Furniss et al. 1991), and log truck traffic on forest roads produces more erosion and higher sediment contributions than light, noncommercial traffic (Luce and Black, 2001b). Driving log trucks on unpaved forest roads produces sediment by degrading the road surface via road widening, surface powdering, rutting, and loss of drainage features (flattening dips, filling open-top drains, etc.). Whether or not any of the sediment is actually delivered to a stream, however, is function of five factors:

1. proximity of the road to streams;
2. volume of log truck traffic;
3. condition of the road surface;
4. time of year that hauling occurs; and
5. the duration of hauling

Because these factors are highly variable, models have difficulty accurately predicting the amount of sediment that log hauling will deliver. Predicting sediment delivery from hauling involves a combination of past monitoring observations and experiences, model predictions, and the scientific literature.

Factor #1. Proximity to Streams

The most likely areas for sediment delivery from haul roads are where roads cross streams (Brown et al. 2014) or encroach within close distance of streams (Elliot and Foltz, 2001; Luce and Black, 1999, 2001a). Croke et al. (2005) studied road stream connectivity in forested terrain and found a mean sediment travel distance of 291 feet below ditch relief culverts. Burroughs and King (1989) observed that 90% of sediment flows below road fill slopes traveled less than 88 feet, suggesting that vegetative filter strips are effective if they are wide enough and have sufficient obstacles to slow channelized flows. Recent road sediment monitoring from a western Montana landscape indicates that most sediment delivered from roads originates within 100 feet of stream channels (Tom Black, personal communication and project file data in U.S. Forest Service, 2014; USDI Fish and Wildlife Service, 2015b). Based on those findings, this BA/BE

assumes that the highest risk of sediment delivery would occur on road segments that are located within 100 feet of streams, which includes stream crossings. These are referred to as "near-stream road segments" in this BA/BE.

For the Proposed Federal Action, road-related sediment delivery was modeled using the Watershed Erosion Prediction Project (WEPP) software as modified for roads analysis (Elliot and Foltz, 2001). This is referred to as the "WEPP:Road model" in this BA/BE. The WEPP:Road model uses road and physical environment related variables to estimate sediment production under various scenarios of use, location, design and maintenance. Our modeling focused on road segments within 100 feet of streams and stream crossings, due to general scientific consensus that these areas produce and deliver the majority of road-related sediment. The WEPP:Road model uses local climate data to best represent the probable weather conditions that are likely to occur during project implementation.

The WEPP:Road model is believed to be one the best tools for this purpose, but it has several inherent weaknesses, including:

- Physical conditions and characteristics are necessarily simplified for the model, resulting in a loss of modeling accuracy; Inclusions of different geology may produce erosion estimate errors;
- Precipitation is estimated from available information and may differ slightly at the modeled site;
- GIS layers for soils, streams and roads may contain spatial errors;
- Soil mass movement (landslides, slumps are not included in erosion estimates;
- Not all variables (application of some BMP's) are accounted for;
- Large climatic events that may occur within the modeling timeframe (such as a 100-year rainfall event) are not predictable;
- Synergistic effects of unpredictable events (wildfire in a unit after vegetation or prescribed fire treatment, large wind throw events);
- Accuracy is plus or minus 50% from predicted rate, at best;
- The model does not compensate for many physical variables, such as soil depth or antecedent moisture conditions or some BMP's; and
- Other assumptions and weaknesses are detailed in the WEPP documentation at http://forest.moscowfsl.wsu.edu/fswepp/docs/fsweppdocu.html

Strengths of the WEPP model include:

- Validation work has been done on similar landscapes, and the model has been used often on the Bitterroot National Forest soil types (Elliot et al. 2000; Elliot and Foltz, 2001; Callahan, 2001);
- It has undergone extensive testing and use since 1995, with constant updating and validation under various scenarios;
- Personnel are familiar with its methods, limitations and strengths through past use; and
- Its accuracy is comparable to (and in some cases better than) other sediment prediction models (Laflen et al. 2004; Hyde et al. 2006).

The WEPP:Road model estimated that unpaved near-stream road segments in the action area deliver between 0.2 and 0.3 tons of sediment per mile of road. The upper limit (0.3 tons/mile) is used for estimating effects in this BA/BE. In the Bitterroot Headwaters TMDL, native surface road stream crossings in the Ditch, Buck, and Hughes creek watersheds were estimated to deliver an average of 1.7 tons of sediment per crossing per year (MDEQ, 2005: pg 150). The available data indicates that considerably more sediment is delivered at road stream crossings than along near-stream road segments.

Table 12 lists the locations in the action area where haul roads would (1) cross streams occupied by bull trout or streams that drain directly into bull trout habitat, or (2) closely parallel within 100 feet of streams that contain bull trout habitat. Paved road segments are highlighted in YELLOW in Table 12; unpaved segments are not highlighted.

Table 12. Haul road segments with highest potential to deliver sediment into bull trout habitat

Affected Bull Trout Population	Affected Stream	Road #	Type of Encroachment	Type of Habitat Affected
Nez Perce local population	Nez Perce Fork	468	2.1 miles< 100 feet from Nez Perce Fork	SR critical habitat
	Nez Perce Fork	468	0.4 miles < 100 feet from Nez Perce Fork	SR critical habitat
	Two Creek	732	0.8 miles < 100 feet from Two Creek [1]	SR critical habitat [1]
	Tough Creek	5644	1.6 miles < 100 feet from Tough Creek [1]	SR critical habitat [1]
	Flat Creek	5637	1.3 miles < 100 feet from Flat Creek [1]	SR critical habitat [1]
	Nelson Creek	468	Stream crossing (culvert)	occupied (rearing)
	Nez Perce Fork	732	Bridge crossing	SR critical habitat
	Nez Perce Fork	5644	Bridge crossing	SR critical habitat
	Little West Fork	468	Bridge crossing	occupied (rearing)
	Little West Fork	5635	Bridge crossing	occupied (rearing)
	Soda Springs Creek	5635	Bridge crossing	occupied (rearing)
	Sentimental Creek	13482	Stream crossing (culvert)	occupied (spawning)
Blue Joint local population	Blue Joint Creek	362	550 feet < 100 feet from Blue Joint Creek	SR critical habitat
Lower West Fork local population	West Fork Bitterroot River	WF Hwy	2.7 miles < 100 feet from river	FMO critical habitat
	West Fork Bitterroot River	WF Hwy	Bridge crossing	FMO critical habitat
	West Fork Bitterroot River	730	Bridge crossing	FMO critical habitat
Rombo Creek population	Rombo Creek	13462	Stream crossing (culvert)	occupied (spawning)
	Rombo Creek	5715	5 stream crossings (culverts) [2]	occupied (spawning)
	Rombo Creek	13446	2 stream crossings (culverts) [2]	occupied (spawning)

[1]The Forest Road 732, 5644, and 5637 segments listed in Table 12 closely parallel (< 100 feet) westslope cutthroat trout streams, but drain into bull trout SR critical habitat in the Nez Perce Fork.

[2] FRs 5715 and 13446 cross several non-fish bearing tributaries that drain into occupied bull trout spawning and rearing habitat in Rombo Creek. The crossings are all culverts.

Log hauling on the West Fork Highway and the paved portion of FR 468 is expected to deliver no sediment to the West Fork Bitterroot River, the Nez Perce Fork, or any tributary streams that these roads cross. The paved road segments are low gradient, 2-lane roads. They are not sediment sources.

The haul road segments not listed in Table 12 consist of upland roads that cross watersheds at mid to upper slopes with generally perpendicular crossings of 1st and 2nd order intermittent and non-fish bearing perennial streams. Increased sediment delivery is likely to occur at the stream crossings when hauling is active, particularly during spring break-up on roads that are used for winter hauling.

Segments of haul roads that are located > 300 feet from streams generally do not deliver sediment to streams. In this BA/BE, road segments that are located > 300 feet from streams are assumed to deliver no sediment.

There are two design features (Appendix B) that would help minimize sediment delivery from the near-stream haul road segments listed in Table 12. These are:

- *On the near-stream road segments of Blue Joint Creek FR 362; Nez Perce FR 468; Two Creek FR 732; Flat Creek FR 5637; and Tough Creek FR 5644, sediment traps will be installed (1) below the outlets of ditch relief culverts within 100 feet of streams; (2) at stream crossings; and (3) in road ditches that drain into streams. The sediment traps will be installed prior to winter hauling and maintained during all periods of winter hauling. The sediment traps may consist of straw bales, straw waddles, fiber logs, slash filter windrows, and/or some combination of straw and slash.*
- *Prior to hauling any logs, the native surface portions of the following near-stream haul road segments will be graveled and BMP upgraded: (1) Two Creek FR 732; (2) Tough Creek FR 5644; and (3) Flat Creek FR 5637. Portions of these road segments have been previously graveled. If the current condition of the gravel surface and the BMPs is deemed to be adequate by Forest engineers and hydrologists, then the previously graveled portions do not need to be re-graveled or have additional BMP upgrade work prior to hauling logs.*

Installing sediment traps on the outlets of ditch relief culverts and other potential sediment delivery points such as stream crossings has proven itself to be an effective method of minimizing road sediment delivery to nearby streams during winter hauling (USDA Forest Service, 2007: pgs 93-94; USDA Forest Service, 2008: pgs 82-84; USDA Forest Service, 2009: pg 71-73; USDA Forest Service, 2010-13; pgs 131-133, 135-137, 139-140; Jakober, 2019; monitoring listed in Project File document AQUATICS-005). In this project, sediment traps would be installed and maintained on the near-stream segments of Ditch Creek FR 66E; Blue Joint Creek FR 362; Nez Perce FR 468; Two Creek FR 732; Flat Creek FR 5637; and Tough Creek FR 5644 if any of those roads are used for winter hauling.

The Bitterroot Headwaters TMDL estimated that adding a 2-6 inch lift of gravel to native surface roads would reduce erosion from the road surface by 50% (MDEQ, 2005: Appendix E, pg E-3). Efta (2009) conducted a sensitivity analysis of the road input parameters in the Disturbed WEPP model (Elliot et al. 1999) which suggested that by applying gravel aggregate to a native road surface, sediment leaving the road can be reduced by as much as 80% under low traffic situations and roughly 40% under high traffic circumstances (high traffic = greater than 4 log truck passes/day, low traffic is typical recreation traffic on a forest road). The reduction in sediment estimated to be leaving the road buffer and potentially being delivered to a stream was approximately 50% (Efta, 2009).

The design features (Appendix B) that would help minimize sediment delivery from the unpaved road stream crossings (culverts) listed in Table 12 are:

- *Roads used for log hauling will be brought up to current BMP standards prior to hauling and will include addition or improvement of existing drivable dips, grading and shaping roads. Special attention will be paid to eliminate or otherwise reduce the effect of ditches that drain into streams.*
- *All of the stream crossings (n = 7) along the Rombo Creek drainage portions of FR 5715 and FR 13446 will be graveled with bentonite aggregate. This will occur in addition to the normal suite of BMP upgrades.*

Factor #2. Traffic Volume

Log truck traffic on forest roads produces more erosion of the road surface and sediment than light, noncommercial traffic (Luce and Black, 2001b). The heavy log trucks tend to rut the road prism, which means the more loads that are hauled, the more likely that rilling, erosion, and sediment mobilization occurs on the road surface during storms and runoff periods. As the number of log truck loads increases, so does the rate of sediment production. A study completed by Foltz (1996) indicates that roads heavily used by log trucks can produce two to 25 times as much sediment over that of lightly used roads.

This BA/BE assumes that 13,500 log truck loads would be hauled in the Proposed Federal Action. This number is likely an over-estimate; however, it was intentionally estimated high to ensure that worst-case scenario effects are analyzed. By main collector road system, the maximum number of log truck loads estimated to be hauled are:

- FR 362 (Blue Joint Creek watershed) = 2,000 loads
- FR 468 (Nez Perce Fork watershed) = 2,000 loads

- FRs 730/5644 (Mud-Bonnie Blue-Basin area) = 2,500 loads
- FR 5635 (Little West Fork watershed) = 1,500 loads
- FR 5715 (Rombo Creek watershed) = 500 loads
- FR 5715 (Buck-Beavertail area) = 5,000 loads

All of these loads would eventually enter the West Fork Highway at various points, which is a paved 2-lane state highway. Upon entering the West Fork Highway, the log trucks would drive north on the highway for 14-20 miles before entering onto U.S. Highway 93.

There is a design feature (Appendix B) that limits the number of log truck loads that can be hauled on FR 362 (Blue Joint Creek), FR 468 (Nez Perce Fork), and the Rombo Creek portions of FR 5715 and FR 13446. This design feature states:

- *A maximum of 2,000 log truck loads will be hauled on Blue Joint Creek FR 362. A maximum of 2,000 log truck loads will be hauled on Nez Perce FR 468. A maximum of 500 truck loads will be hauled in the Rombo Creek drainage on FR 5715 between the Buck Creek Saddle and the junction of FR 13446 to FR 5715. A truck load is defined as one log truck driving into the landing empty, and then driving back out loaded with logs and headed to the mill*.

The purpose of this design feature is to limit the duration of potential sediment delivery on FRs 362, 468, and the Rombo portion of FR 5715 to an approximate three-year time frame. There are no restrictions on the number of log truck loads on the other roads in the action area.

Factor #3. Condition of the Road Surface

The condition of the road surface affects how well the road will be able to withstand the wear and tear caused by log trucks. Native surface roads are much more likely than gravel roads to powder when dry, and subsequently rut when the first rain storms arrive. Roads graveled with quality aggregate (e.g. bentonite gravel) are more resistant to rutting and powdering than native surface roads. The amount of rutting and erosion that occurs is highly dependent on the weather. Generally, dry, well-drained and well-surfaced roads withstand rutting from truck traffic and release minimal sediment to the surrounding land. When hauling occurs during wet periods such as spring break-up, however, roads can develop substantial ruts and deliver large amounts of sediment to nearby streams for several weeks (USDA Forest Service, 2003: pg 81; USDA Forest Service, 2014-15: pgs 59-62; Brassfield, 2015). Burroughs and King (1989) estimated an increase of about 200% in road surface erosion rates if rutting occurs along with heavy truck traffic. Foltz (1996) found that logging traffic on wet roads produced 2-25 times as much sediment as no traffic.

In the Proposed Federal Action, all of the near-stream haul road segments listed in Table 12 would have either a gravel aggregate or paved surface, and be upgraded to meet BMP standards before hauling occurs. Most of the near-stream segments are already either graveled (FR 362; FR 468), paved (West Fork Highway; lower four miles of FR 468), or partially graveled (FR 732; FR 5644). FR 5637 along Flat Creek is the only near-stream road segment that currently has no gravel at all. The findings of Efta (2009) suggest that graveling a native road surface can reduce its sediment production by as much as 80% under low traffic situations and roughly 40% under high traffic circumstances, with about a 50% reduction in the amount of sediment being delivered to nearby streams. In the Bitterroot Headwaters TMDL, MDEQ assumed that a 2-6 inch lift of gravel would reduce erosion from road surfaces by an estimated 50% (MDEQ, 2005: Appendix E, pg E-3). Using rainfall simulations, Brown et al. (2014) found that runoff from native surface stream crossings in the Virginia Appalachians produced 3.5 times more total suspended solids than runoff from crossings that had 50-99% of their road approach length surfaced with gravel. Sugden (2018) reported that sediment delivery from legacy road systems on Plum Creek Timber Company lands in western Montana was reduced by an average of 46% (range -84% to +57%) over a 10-15 year period following BMP upgrades.

The WEPP:Road model runs that were made for the Proposed Federal Action (Table 13) indicate that with properly applied and maintained BMPs, log truck traffic over stream crossings and on near-stream road segments could deliver <u>less</u> sediment to streams than the existing traffic load is currently delivering. This seems counter-intuitive; however, it underscores the importance of properly installed and maintained

BMPs, which many of the existing roads in the action area currently do not possess. After hauling is over, the WEPP:Road model predicts an even greater reduction would occur because of the BMP upgrades (Table 13).

Table 13. WEPP:Road Model Estimated Sediment Delivery from Stream Crossings and Roads within 100 feet of Streams (pounds of sediment delivered per year for a 200 foot long segment of road):

	Low or No Traffic (the existing condition)	**Hauling with BMP's**	**Post Haul, BMP's Applied and Maintained**
Outsloped Road Open	113.39 lbs (or 1.5 ton/mi)	47.31 lbs (or 0.62 ton/mi) (59% reduction)	22.04 (or 0.29 ton/mi) (81% reduction)
Outsloped Road Closed Year-long	87.74 lbs (or 1.2 ton/mi)	47.31 (or 0.62 ton/mi) (46% reduction)	15.44 (if closed 0.20 ton/mi) (82% reduction)
Insloped Road Open	111.7 lbs (or 1.5 ton/mi)	31.46 (or 0.42 ton/mi) (72% reduction)	16.3 (or 0.22 ton/mi) (85% reduction)
Insloped Closed year-long	87.74 lbs (or 1.2 ton/mi)	31.46 (or 0.42 ton/mi) (65% reduction)	9.35 (or 0.12 ton/mi) (89% reduction)

Hauling on paved road segments (e.g. West Fork Highway; lower four miles of FR 468) is expected to deliver no sediment to streams.

Log trucks typically produce a lot of dust when hauling occurs in summer and autumn. The amount of dust that lands on the surface of streams or coats the vegetation along the stream banks varies depending on proximity to streams, traffic volume, the condition of the road surface, and the time of year that the hauling occurs. Heavy summer/autumn hauling on dry gravel or native surface roads within 100 feet of streams causes the most dust to land on the surface of streams or coat the vegetation along the stream banks. Dust is an air quality nuisance to humans, but as far as fish and other aquatic organisms are concerned, its particles are too small to visibly degrade water clarity or accumulate in the stream bottom to the degree needed to adversely affect aquatic life. When dust lands in the stream, the particles quickly become widely dispersed throughout the water column as they are transported downstream. With the exception of instances where road dust was contaminated with toxic chemicals, we could find no studies in the literature that identified sediment delivery from road dust as a threat to fish or other aquatic organisms.

If dust abatement is used on Mud Creek haul roads, the substance applied would be water and not chloride-based chemicals. FR 468 is notorious for heavy dust concentrations during the dry parts of the summer. If any water applications occur for dust abatement purposes in the Proposed Federal Action, they would most likely occur on FR 468.

Factor #4. Time of Year

Hauling during summer and autumn usually produces less road surface erosion and sediment movement than hauling during spring and winter, which are wetter times of the year. Summers and autumns on the Bitterroot NF are typically dry, and hauling that occurs during those times of year tends to produce a lot of dust, but minimal rilling of the road surface or sediment delivery (USDA Forest Service, 2008: pg 83; USDA Forest Service, 2009: pg 71; USDA Forest Service, 2010-13; pgs 131-137, 139-140; USDA Forest Service, 2014-15: pg 65).

Monitoring has shown that hauling in winter is more unpredictable than hauling in summer or autumn. With adequate winter conditions and careful administration, it can produce very little sediment (USDA Forest Service, 2004: pg 87; USDA Forest Service, 2006: pg 76; USDA Forest Service, 2007: pgs 92-95; USDA Forest Service, 2008: pg 83; USDA Forest Service, 2009: pg 71; USDA Forest Service, 2010-13; pgs 131-140; USDA Forest Service, 2017; Jakober, 2019). On the other hand, if winter hauling is allowed to continue during periods of unusual warmth or during spring break-up, it can deliver large amounts of

sediment from near-stream road segments in a short amount of time (USDA Forest Service, 2003: pg 81; USDA Forest Service, 2014-15: pgs 59-61; Brassfield, 2015).

Hauling in winter is riskier because it occurs when the roads are more likely to experience rain-on-snow events, unusually warm thaws, and/or spring break-up. All of these factors increase the chances of log trucks rutting the road's ice surface. Once the ruts have formed, they are impossible to erase and one can only wait until the ice melts all the way down to the bare dirt surface, which usually takes several weeks. During those weeks, the ruts channelize sediment-laden runoff during the warmer afternoons. The runoff eventually jumps off the road shoulder and flows down the fillslope. If a stream is nearby, the turbid runoff will flow directly into the stream. This occurred on FRs 321 (North Rye Creek) and 75 (Rye Creek) during spring break-up in 2002 and 2003 (USDA Forest Service, 2003: pg 81). It also occurred in Ambrose Creek on the Stevensville Ranger District in 2015 (USDA Forest Service, 2014-15: pgs 59-62; Brassfield, 2015).

With the exception of FR 468 in the Nez Perce watershed (HUC 0204), there would be no restrictions on the season of log haul in the Proposed Federal Action. It is likely that the majority of hauling would occur in summer and autumn, but winter hauling may also occur, albeit likely on a smaller scale. The Bitterroot NF portion of FR 468 is closed to full size vehicles starting on December 1 and continuing through the winter until April 1. During the closure period, FR 468 is used by snowmobiles, dog sleds, and nordic skiers. Because of the closure, all of the hauling on FR 468 would be restricted to periods between April 1 and December 1, which typically encompass the drier parts of the year.

Factor #5. Duration of Hauling

The longer that hauling occurs, the greater the risk that the haul roads would be exposed to high intensity erosion events, and the more likely that additional road maintenance activities such as grading and snow plowing would be needed. In general, the fewer years that hauling occurs, the better the long-term outcome for aquatic resources.

In the Proposed Federal Action, it is assumed that log hauling would occur for a duration of 3-5 years on the main collector road systems. On FRs 362, 468, and the Rombo portion of FR 5715, three years is a reasonable time frame to haul 500 (Rombo portion of 5715) to 2,000 (362, 468) truck loads provided that unforeseen events such as fires or virus outbreaks do not extend the hauling period.

To summarize the findings of the five factors described above,

> Factor #1, proximity to streams. The most likely points of sediment delivery during hauling would occur at road stream crossings and along road segments that are < 100 feet from streams (Table 12). Of those two, road stream crossings have the higher risk of delivering sediment.
>
> Factor #2, volume of log truck traffic. A maximum of 13,500 log truck loads is estimated to be hauled in the Proposed Federal Action. 2,000 loads would be the maximum allowed to haul out of the Nez Perce Fork watershed on FR 468. 2,000 loads would also be the maximum allowed to haul out of the Blue Joint Creek watershed on FR 362. 500 loads would be the maximum allowed to haul on FRs 5715 and 13446 in the Rombo Creek drainage. The remaining loads would come down upland road systems (FRs 730, 5635, and the Ditch/Buck/Beavertail portions of FR 5715) and enter paved roads (West Fork Highway and the Ravalli County portion of FR 468).
>
> Factor #3, road conditions during hauling, and Factor #4, time of year. These two factors are closely related. All of the hauling on near-stream road segments would occur on graveled surfaces that have been BMP upgraded, or on paved surfaces. The upland roads would also be BMP upgraded, and the stream crossings on the Rombo Creek portions of FR 5715 and FR 13446 would be graveled with bentonite aggregate prior to hauling. The WEPP:Road model predicts that with properly applied and maintained BMPs, log truck traffic over road stream crossings and on near-stream road segments is likely to deliver less sediment to streams than the existing traffic load is currently delivering (Table 13). No sediment delivery is expected to occur from hauling on paved road segments.
>
> With the exception of FR 468 in the Nez Perce watershed, there would be no restrictions on the season of log haul in the Proposed Federal Action. Most of the hauling is likely to occur in summer and autumn when road conditions are at their driest, with a lesser amount of winter hauling occurring. The Bitterroot NF portion of FR 468 is closed to all motorized vehicles except snowmobiles from December 1 to April 1. Because of that closure, no winter hauling would occur on FR 468. All of the

hauling that occurs on the near-stream road segments in the action area would occur on graveled or paved surfaces that have received BMP upgrades.

Factor #5, duration of log hauling. This BA/BE assumes that log hauling would occur for a duration of approximately 3-5 years on the main collector road systems, and approximately three years on FRs 362, 468, and the Rombo portion of FR 5715.

When you combine all five factors, the conclusion of this BA/BE is that log hauling is going to deliver sediment into bull trout habitat, but because of BMPs, the amount would be minimized to the point where it is unlikely that we would be able to measure or meaningfully evaluate its effects on bull trout individuals or habitat conditions.

There are two bull trout streams in the action area where the baseline condition for the *Sediment* and *Substrate Embeddedness* indicators is currently considered to be in adverse condition (FUR). These are (1) the Nez Perce Fork and (2) Rombo Creek. The portions of the road network where hauling has potential to deliver some sediment into bull trout habitat are:

1. the near-stream segments of FR 468 along the Nez Perce Fork between Two and Flat creeks (3.2 miles of SR critical habitat); and
2. seven stream crossings that drain into the Bitterroot NF portions of Rombo Creek (2.5 miles of lightly occupied spawning and rearing habitat).

With proper installation and maintenance of BMP's – this is absolutely critical - the WEPP:Road model predicts that hauling would deliver less sediment from these areas than what the existing traffic load is currently delivering (Table 13). Assuming this occurs, the BMPs would eventually result in gradual improvements in the quality of spawning and rearing habitat over time. The benefits gained from graveling near-stream road segments and road stream crossings are expected to last for at least ten years on road segments such as FR 468 that receive heavy traffic, and considerably longer on lightly traveled roads such as those in the Rombo Creek drainage.

5.2.1.4 Treatments on Existing Roads

This category includes the reconstruction, reconditioning, decommissioning, and/or storage of roads that have existing prisms. The literature indicates that during these types of ground-disturbing activities, the following areas are places where sediment delivery to streams is likely to occur:

- Road segments located within 100 feet of streams (USFWS, 2015b: pgs 7, 36)
- Stream reaches within 810 m (2,673 feet) downstream of culvert removal sites (Foltz et al. 2007b)

Road reconstruction and reconditioning

These activities involve clearing vegetation and obstacles (rocks, wood) from the driving surfaces of roads so that the roads can be driven on by logging equipment and log trucks. The driving surfaces of reconditioned or reconstructed roads are typically scraped to mostly bare ground by a dozer or grader. Soil is usually sidecast over the fillslope. The highest risk for sediment delivery occurs where (1) the approaches to road stream crossings are scraped bare, and (2) sidecasting occurs within 100 feet of streams.

Road reconstruction and/or reconditioning could potentially occur on any maintenance level 1 or 2 roads in the action area that are currently impassible due to vegetation or obstacles. There is approximately 346 miles of maintenance level 1 and 2 roads in the action area, with 138 crossings of NHD streams (Table 1). An unknown amount of the 346 miles is currently driveable and would not need treatment to use for timber harvest and log truck access.

The crossing density of the maintenance level 1 and 2 roads averages one stream crossing for every 2.5 miles of road. The roads cross 1st and 2nd order headwater tributaries (non-fish bearing) at middle to upper slope locations. About half of the crossings are on ephemeral or intermittent streams; the other half on small perennial streams. The roads are not located within 100 feet of streams for significant lengths.

The following design features would apply to road reconstruction and reconditioning (Appendix B):

- *On reconditioned or reconstructed roads, the grading that occurs at stream crossings will:*

- *Leave as much of the existing vegetation on the travelway as possible.*
- *Avoid sidecasting road material within RHCAs (sidecasting is prohibited in RHCAs).*
- *Install driveable dips on the uphill approach within 100-200 feet of the stream crossings to divert water and sediment from the travelway prior to the road entering the stream crossing area. The exact location of the dips will depend on individual site conditions such as road slope, presence of ditch in the road design, rock outcrops, and channel location.*
- *Gravel stream crossings on open roads. Addition of surface rock on maintenance Level 1 and 2 roads at stream crossings will be dependent upon site conditions and consultation with engineering, fisheries or hydrology.*

- *Side-casting of road material (during road grading and snowplowing) into RHCAs is prohibited (SMZ Rule #8).*
- *Road maintenance activities will follow the minimization measures for each road activity type specified in the April 2015 Road-Related Activities Biological Opinion (USFWS, 2015b).*
- *There will be no side-casting of soils in RHCAs. This prohibition applies to all types of road and trail construction and maintenance activities.*

At road stream crossings, the reconditioning and/or reconstructing of roads is likely to increase the amount of sediment that is contributed to the headwater reaches of some of the 1st and 2nd order non-fish bearing tributaries in the action area. Adherence to the design features should reduce the amount of sediment that gets into the streams to quantities that are undetectable in the stream bottom within about the first 100 feet of stream channel below the road crossing. Some of that sediment may eventually get transported further downstream into the upper reaches of occupied westslope cutthroat trout habitat in the small tributaries to Blue Joint Creek (Took, Magpie, trib 3.8, and Sand creeks), the Nez Perce Fork (Two, Tough, and Flat creeks), and the West Fork Bitterroot River (Beavertail, Buck, Ditch, Rombo, Line, and Mud creeks). In any of those streams, the quantity of sediment that makes its way into occupied westslope cutthroat trout habitat is expected to be too small to produce detectable changes in fish numbers, sizes, or habitat structure. Any effects to bull trout or bull trout critical habitat that is located even further downstream in Blue Joint Creek, the Nez Perce Fork, and the West Fork Bitterroot River would be insignificant.

Road decommissioning and storage

The 2015 Road-Related Activities Biological Opinion (USFWS, 2015b) concluded that road decommissioning and storage that occurs within 100 feet of bull trout habitat generally results in unavoidable, short-term adverse sediment effects. At distances greater than 100 feet from bull trout habitat, sediment effects are generally insignificant or have no effect although in certain instances effects can vary based on site-specific features (USFWS, 2015b: pgs 7, 36). On the Bitterroot NF, monitoring of decommissioned and stored road segments greater than 100 feet from streams has found no indications of sediment delivery (USDA Forest Service, 2019b). Vegetated filter strips that are wider than 100 feet have been effective at preventing non-channelized sediment from being able to enter streams. For those reasons, this BA/BE will only focus on road segments that are decommissioned or stored within 100 feet of streams. Road segments that are decommissioned or stored at distances greater than 100 feet from streams are considered to have no direct or indirect effects on fish habitat.

There are four road segments closer than 100 feet from streams (excluding road stream crossings, which are discussed below) that would be decommissioned or stored in the action area. These are:

1. 0.6 miles of FR 66E along Ditch Creek (occupied westslope cutthroat trout habitat)
2. 1.1 miles of FR 361 along Beavertail Creek (occupied westslope cutthroat trout)
3. 0.4 miles of FR 74046 along Two Creek (upstream of occupied westslope cutthroat trout habitat)
4. 0.7 miles of FR 74049 along One Creek (non-fish bearing intermittent stream)

Decommissioning or storing these near-stream road segments would have insignificant effects on bull trout and bull trout habitat. Bull trout are absent in the streams that parallel the road segments, and the only stream with potential to deliver sediment into downstream bull trout habitat (FMO critical habitat in the West Fork Bitterroot River) is Ditch Creek. Ditch Creek is intermittent in its lower end at base flows, and only contributes a small amount of overland flow to the West Fork during spring and early summer. Any sediment delivered to Ditch Creek by decommissioning FR 66E that eventually gets routed downstream

into the West Fork would be too miniscule to have a detectable effect on bull trout and bull trout FMO critical habitat. On FRs 74046 and 74049, the only ground-disturbing activity would be recontouring or blocking the entrances to those roads. This would have no effect on fish or their habitat.

Recontouring the near-stream segments of FR 66E (Ditch) and FR 361 (Beavertail) would increase sediment delivery into about 1.7 miles of adjacent westslope cutthroat trout spawning and rearing habitat for the first 1-3 years following recontouring. The portions of those streams adjacent to the recontoured segments already contain high levels of sediment (Figure 17). The sediment increases caused by the recontouring could reduce substrate hiding cover and increase pool tail fines for 3-4 years while the recontoured prisms are recovering sufficient vegetative cover. This could cause some westslope to temporarily abandon their rearing/holding habitats to search for better ones, which could result in reduced growth and survivorship, particularly among the juvenile and young-of-the-year life stages. It could also reduce egg survivorship for 4-5 spawning years. Beyond three years, when the recontoured prisms have adequately revegetated and are no longer delivering much sediment, the quality of the spawning and rearing habitat adjacent to the recontoured road prisms is expected to commence a long and gradual improving trend.

Monitoring on the Bitterroot NF indicates that erosion and sediment production gradually declines from recontoured road prisms over an approximate three-year period as vegetation fills in the bare soils near the stream channel (USDA Forest Service, 2019b). After three years post-treatment, sediment production has declined to negligible levels (USDA Forest Service, 2019b), but infiltration and erodibility rates still have not recovered to those of an intact forest floor (Foltz et al. 2007a). This BA/BE assumes that starting at three years post-treatment, the recontoured road prisms would no longer be producing or delivering sediment to streams. From that point forward, a permanent reduction in sediment delivery would occur as the recontoured road prisms recover their natural vegetation. Over a period of several decades, this should result in cleaner stream bottoms (and better fish habitat) adjacent to and immediately downstream from the recontoured road segments.

Culvert removals

Road stream crossings are places in a watershed where road sediment is chronically delivered to streams (Brown et al. 2014). In the Bitterroot Headwaters TMDL, MDEQ estimated that road stream crossings in the Buck, Ditch, and Hughes creek watersheds delivered an average of 1.7 tons of sediment per crossing per year (MDEQ, 2005: pg 150). Because of similar geologies and road conditions, this is a reasonable estimate to apply to all of the native surface road crossings in the action area.

When roads are decommissioned or placed in storage, the culverts are typically removed from the stream crossings and the portions of the roads that cross through the drainage are recontoured back to their natural slopes. Foltz et al. (2007b) found that when BMPs were applied during culvert removals on small perennial streams, the amount of direct sediment that was delivered to the stream averaged 1.6 kg, or about 3.5 lbs. Most of this sediment gets deposited within the first 200 m (660 feet) of stream channel below the crossing site and occurs within the first 24 hours following removal (see authors cited in USFWS, 2012; 2015b). Suspended sediment concentrations were similar to the unaffected stream above the road crossing an average of 810 m (2,673 feet) downstream of the culvert removal sites (Foltz et al. 2007b). Based on these findings, this BA/BE assumes that any occupied fish habitat that is located within 810 m downstream of a culvert removal site would receive short duration (< 24 hours) pulses of suspended sediment. Only habitats within 200 m of the culvert removal site are expected to receive a visible amount of sediment deposition. Habitat that is located > 810 m downstream of the culvert removal sites is likely to be unaffected by the removal.

There are only two road stream crossings in the action area where occupied fish habitat is located within 200 m below a culvert removal site. These two crossings are:

1. the first 200 m of Rombo Creek below the FR 13462 culvert removal site (bull trout and westslope cutthroat trout habitat); and
2. the first 200 m of Beavertail Creek below the FR 361 culvert removal site (westslope cutthroat trout habitat).

In Rombo Creek, sediment delivered by the removal of the FR 13462 culvert and recontouring of the road drainage crossing may force a low number (< 5 fish) of juvenile or small resident bull trout to temporarily

abandon their habitats near the removal site and move further downstream to avoid harassment, intermittent pulses of turbidity, and reductions in interstitial rearing habitats and macroinvertebrate food supply due to sediment infill. This sudden abandonment of habitat could cause behavioral changes such as reduced feeding efficiency and growth rates and increased physiological stress. These factors increase the likelihood of mortality. Scattered patches of suitable spawning gravels located within 200 m below the FR 13462 culvert may also be degraded for a year or so by higher levels of fines. Similar effects are likely to occur below the FR 361 removal site on Beavertail Creek, but there are no bull trout in that stream, and only westslope cutthroat trout would be affected.

The rest of the culvert removals that occur in the action area would occur in small 1st and 2nd order intermittent and perennial non-fish bearing stream reaches, mostly at distances > 810 m upstream from the nearest occupied (by small westslope cutthroat trout) fish habitat. These removals would have insignificant direct effects on westslope cutthroat trout and their habitat, and no direct effects on bull trout. Within a year or two of the removals, a small amount of the sediment that was delivered during the culvert pulling and recontouring could eventually get transported downstream into bull trout SR critical habitat in larger streams such as Blue Joint Creek and the Nez Perce Fork. However, by the time it gets there, the sediment would be so widely dispersed that its effect on bull trout and critical habitat would be undetectable.

The key benefit to be gained by the culvert removals is a long-term and maybe even permanent reduction in sediment delivery at each of the crossing sites. Assuming that each removal site in the action area currently delivers about 1.7 tons of road sediment to the stream network each year (MDEQ, 2005: pg 150), and there are approximately 35 removal sites in the action area, a one-time delivery of about 1.6 kg of sediment per site (Foltz, 2007b) is a small price to pay for the tons of sediment that would no longer be delivered to the stream network. Over time, the quality of downstream bull trout and westslope cutthroat trout spawning and rearing habitats would improve because of these sediment reductions.

The conclusion of this BA/BE is that of all of the treatments that occur on existing roads, only the removal of the FR 13462 culvert on Rombo Creek would have negative, short-term effects on bull trout individuals and habitat. The rest of the treatments would deliver insignificant amounts of sediment to bull trout habitat. For westslope cutthroat trout, removing the FR 361 culvert on Beavertail Creek and recontouring the near-stream road segments of FR 66E (Ditch Creek) and FR 361 (Beavertail Creek) would have negative, short-term effects on westslope cutthroat trout individuals and habitat, followed by long-term improvements in habitat quality and accessibility.

5.2.1.5 Prescribed Burning

Prescribed burning is a potential sediment source because it removes vegetation and exposes bare soil. In the Proposed Federal Action, prescribed burning and manual thinning, piling, and pile burning of sub-merchantable ladder fuel trees could occur anywhere in the action area as long as they comply with the design features (Appendix B). Follow-up burning treatments would also occur in the majority of the timber harvest units after all of the harvest has been completed. These post-harvest burning treatments could consist of underburning, jackpot burning, and/or pile burning. The design features are consistent with the mitigation measures in the U.S. Fish and Wildlife Service's programmatic biological assessments for prescribed fire (USFWS, 2001) and timber stand improvement (USFWS, 1999).

Prescribed burns are typically conducted during times of the year when humidity and fuel moisture in riparian areas are relatively high, which reduces fire intensity and retards flame spread in riparian zones (Dwire and Kauffman, 2003). Beche et al. (2005) monitored the effects of a low-to-moderate intensity prescribed fire that was ignited in the riparian area along a Sierra Nevada stream, and found either no or only short-term impacts on water chemistry, quality, macroinvertebrates, and physical stream habitat one year after the fire. Harris et al. (2007) reported similarly minimal impacts for prescribed fires in the Blue Mountains of eastern Oregon and Washington. The low severity nature of prescribed burns maintains a functioning duff layer, which preserves soil infiltration capacity and greatly reduces the potential for overland flow and sediment delivery to streams (Robichaud, 2000; Wondzell and King, 2003).

Over the past decade, Forest fisheries biologists and hydrologists have monitored numerous prescribed burns on the Bitterroot NF (USDA Forest Service, 2007: pg 82; USDA Forest Service, 2008: pgs 67-68; USDA Forest Service, 2009: pg 60; USDA Forest Service, 2010-13: pgs105-112; USDA Forest Service, 2014-15: pgs 43-46; USDA Forest Service, 2019a: AQT-03; Jakober, 2018; 2019; Project File document

AQUATICS-005). With the exception of a few localized instances, these burns have been of low severity and have had negligible effects on riparian vegetation and aquatic fauna. Monitoring indicates that with the application of the design features listed in Appendix B, prescribed burning is unlikely to add significant (i.e. measurable) quantities of sediment to streams. The recovery of herbaceous vegetation after prescribed burning typically occurs within 1-2 growing seasons, and hillslope erosion (rilling) is uncommon. The RHCAs surrounding streams typically do not burn much during prescribed fires, and where fire does back down into the RHCAs, it tends to burn at low severity in a very spotty pattern. Rarely does prescribed fire burn all the way down to the edges of the stream banks with any appreciable severity or extent of coverage.

In the Proposed Federal Action, it is anticipated that the prescribed burning would be predominantly of low severity, the vast majority of stream banks in the action area would remain unburned, and the duff layer would be preserved on the surrounding upland slopes. For those reasons, the conclusion of this BA/BE is that prescribed burning and its associated manual thinning treatments would deliver insignificant amounts of sediment to bull trout and/or westslope cutthroat trout habitat.

5.2.1.6 Summary of Sediment-Producing Activities

Log hauling is going to deliver some sediment into bull trout habitat, but because of BMP's, the amount should be minimized to the point where it is unlikely that we would be able to measure or meaningfully evaluate its effects on bull trout individuals or habitat conditions.

There are two bull trout streams in the action area where the baseline condition for the *Sediment* and *Substrate Embeddedness* indicators are currently considered to be adverse (FUR). These are the Nez Perce Fork and Rombo Creek. The portions of the road network where hauling has potential to deliver some additional sediment into bull trout habitat in those adverse baseline streams are:

1. the near-stream segments of FR 468 along the Nez Perce Fork between Two and Flat creeks (3.2 miles of SR critical habitat); and
2. the seven road stream crossings that drain into the Bitterroot NF portion of Rombo Creek (2.5 miles of lightly occupied spawning and rearing habitat).

By graveling these segments and stream crossings and installing other BMP's, the WEPP:Road model predicts that hauling would deliver less sediment from these areas than what the existing traffic load is currently delivering (Table 13). This would result in gradual improvements in the quality of spawning and rearing habitat over time.

With the exception of the removal of the FR 13462 culvert on Rombo Creek, the treatments that occur on existing roads (i.e. reconditioning, reconstruction, decommissioning, and storage) are expected to deliver insignificant amounts of sediment into bull trout habitat. Sediment delivered by these activities would be indirect (occurring upstream of occupied habitat and/or later in time), widely scattered in location, and too small to produce measurable effects on bull trout individuals and habitat.

Removing the FR 13462 culvert on Rombo Creek would cause visible and measurable sediment deposits throughout the first 200 m of bull trout spawning and rearing habitat below the road crossing. Similar effects are likely to occur below the FR 361 removal site on Beavertail Creek, but there are no bull trout in that stream, and only westslope cutthroat trout would be affected.

The new road construction (specified roads, temporary roads, and TLM trails) that occurs in the bull trout priority watersheds (Little West Fork HUC 0203; Nez Perce Fork HUC 0204; and Lower Blue Joint HUC 0106) would avoid RHCAs, and because of that avoidance is unlikely to deliver any meaningful quantities of sediment to streams. Elsewhere in the project area, new road construction (specified roads, temporary roads, and TLM trails) would also avoid RHCAs with the exception of four new specified road stream crossings (one on upper Ditch Creek, two on intermittent tributaries to Ditch Creek, and one on an intermittent tributary to Mud Creek). All of the new crossings would occur in non-fish bearing reaches in non-bull trout drainages. The new stream crossings would have no effect on bull trout or bull trout habitat. The nearest bull trout habitat is located in the West Fork Bitterroot River, more than 1.5 miles downstream from the stream crossings.

The construction of new motorized trails would occur outside of RHCAs and is not expected to deliver sediment to streams.

Prescribed burning treatments are expected to deliver insignificant amount of sediment to bull trout habitat.

Timber harvest activities are unlikely to deliver sediment to streams. By keeping watershed ECAs below 20%, stream flow increases resulting from canopy cover reductions are expected to be too small to cause accelerated bank erosion, changes in stream channel dimensions/stability, and increased sediment delivery.

5.2.2 Water Temperature

With the exception of about 19 acres in areas 1, 2, and 3, there would be no timber harvest in the RHCAs in the action area. The limited amount of selective harvest (19 acres) that occurs in the outer half of the 300-foot RHCAs of areas 1, 2, and 3 would maintain all of the existing shade cover on stream channels, and would not have a measurable effect on stream temperatures. The preservation of existing shade cover on stream channels would ensure that the timber harvest activities do not alter stream temperatures. Any microclimate alterations caused by the removal of timber in lands adjacent to the RHCAs would occur on too small of a scale to measurably affect temperatures in adjacent streams. This prediction is based on the findings of Moore et al. (2005) and Anderson et al. (2007).

The design features for prescribed burning and manual thinning (Appendix B) have been shown to satisfactorily preserve riparian shade cover (USDA Forest Service, 2007: pg 82; USDA Forest Service, 2008: pgs 67-68; USDA Forest Service, 2009: pg 60; USDA Forest Service, 2010-13: pgs 105-112; USDA Forest Service, 2014-15: pgs 43-46; USDA Forest Service, 2019a: AQT-03; Jakober, 2018; 2019; Project File document AQUATICS-005). The available evidence strongly suggests that the prescribed burning and manual thinning activities in the Proposed Federal Action would adequately preserve the existing shade cover on streams, and no measurable changes to stream temperatures would occur as a result of those activities.

Where culverts are removed on decommissioned or stored roads, pulling the culvert and restoring the natural contour of the drainage crossing exposes about 40 feet of barren stream channel per crossing. If the barren stream banks are planted with shrub seedlings, it takes about a decade for shade cover to fully recover back to its pre-disturbance level (USDA Forest Service, 2019b). If the site is not planted, it could take at least two decades for shade recovery to occur, with aspect being a key factor (shaded north aspects recover quicker than south aspects).

Culverts would be removed at about 35 road stream crossings in the action area. The removal sites are scattered across the action area and not concentrated within any particular watershed. At least half of the removals would occur on intermittent streams which are likely to be dry or nearly dry at the time of removal. The patches of solar exposure that are created as a result of the culvert removals would be too small and scattered across the landscape to measurably warm temperatures downstream of the sites where fish live. Only two of the culvert removals would occur on fish-bearing streams (Rombo Creek, FR 13462 crossing and Beavertail Creek, FR 361 crossing); the rest would occur on small (generally < 3 feet wetted width), non-fish bearing 1st and 2nd order intermittent and perennial tributaries located in the middle to upper portions of watersheds.

The construction of four new specified road stream crossings (culverts) would cause small increases in solar exposure on four intermittent stream reaches in the headwaters of the Ditch and Mud creek drainages. The amount of surface water exposed to increased solar radiation would be too small to affect temperatures in the West Fork Bitterroot River (the nearest bull trout habitat) more than 1.5 miles downstream of the new crossings.

Other than removing culverts and constructing the four new road stream crossings, the remainder of the treatments that occur on existing roads and trails (decommissioning, storage, reconstruction, and reconditioning) would maintain the existing shade cover on streams.

The conclusion of this analysis is that the activities in the Proposed Federal Action are expected to maintain stream temperatures in all of the fish-bearing streams in the action area.

5.2.3 Water Chemistry

There are two pollutants of concern in the Proposed Federal Action: (1) sediment; and (2) herbicide chemicals (i.e. active ingredients). Contamination of water by fuel or hydraulic fluids is considered to be a

discountable risk. There is a design feature that directs fuel storage, fuel mixing, and equipment refueling activities to occur outside of RHCAs. If no suitable sites are available outside of RHCAs, refueling in RHCAs may occur, but must be pre-approved by the fisheries biologist or hydrologist and have an approved spill containment plan. There is also a design feature that mandates that heavy equipment be washed and inspected for leaks before it can operate in the action area. Adherence to those two design features would minimize the risk of a fuel or hydraulic fluid spill in streams to a discountable level.

The prescribed burns in the Proposed Federal Action are anticipated to be low severity events that retain the majority of the riparian vegetation bordering streams in an unburned condition. Those types of burns are unlikely to alter nutrient levels in streams to a measurable degree.

The Proposed Federal Action includes the option of spraying herbicides on areas of ground disturbance created by project activities. This would be a "targeted" application – not a broadcast application. Areas specifically targeted would be temporary roads, recontoured roads and/or trails, landings, skid trails, and areas around rare plant populations that are threatened by weeds. Application would occur by ground-based methods (backpack sprayers and/or vehicle-mounted sprayers), and no herbicides would be applied in RHCAs.

The following design features would apply to herbicide applications (Appendix B):

- *Prior to any applications, aquatic specialists will complete and document toxicity calculations that show that the active ingredient applied will be of a LOWER CONCENTRATION than the 96-hour LC_{50} value divided by 25 ($LC_{50}/25$) found in the literature for either rainbow trout or cutthroat trout, whichever is lowest. The $LC_{50}/25$ is known as the "maximum acceptable toxicant concentration (MATC)". Toxicity will be calculated at the subwatershed scale (e.g. Beavertail Creek, Ditch Creek, Tough Creek, etc), NOT the HUC 12 scale.*
- *Herbicides will not be applied in RHCAs.*
- *Only ground-based methods (backpack sprayers and/or vehicle-mounted sprayers) will be used to apply herbicides.*
- *Herbicides will be applied according to label directions.*

Adherence to the design features is expected to keep active ingredient concentrations in streams at levels that are too small to detect, and too small to have measurable effects on bull trout. Herbicides would only be applied at concentrations that are calculated to be lower than the LC_{50} values documented in risk assessments for rainbow or cutthroat trout divided by 25. The LC_{50} is the concentration of herbicide that is lethal to 50 percent of the test organisms exposed to that concentration for 96 hours. LC_{50} values are not available for bull trout in the risk assessments but are available for rainbow trout and/or cutthroat trout and these are commonly used as surrogates. The $LC_{50}/25$ is called the "maximum allowable toxicant concentration", or MATC. The U.S. Fish and Wildlife Service believes that if herbicide concentrations are equal to or less than the MATC, then all aquatic species will be reasonably protected; certain individuals may still react to the herbicide but the overall population is considered safe (Mayer and Ellersieck 1986). The MATC method is comparable to methods used in risk assessments conducted by the Forest Service and complies with directions outlined in Forest Service Manual FSM 2900 (2011).

5.2.4 Woody Debris Recruitment

The recruitment of large wood into stream channels is the most important process that creates and maintains complex habitats, pools, and hiding cover for bull trout and westslope cutthroat trout in the action area. The RHCA buffer widths in the Proposed Federal Action would protect the woody debris recruitment "caution zones" described in the bull trout Biological Opinion (USFWS, 1998b: Appendix 5), and would be wide enough to maintain essentially all of the woody debris recruitment to stream channels that naturally occurs in riparian corridors, wetlands, and landslide prone areas (Naimen et al. 2000).

Manually thinning sub-merchantable conifers > 50 feet from streams and wetlands would have a negligible effect on present and future woody debris recruitment (USFWS, 1999). The trees that would be cut would be too small and too far from water bodies to contribute woody debris. The dense growing conditions would also prevent their growing large enough to provide stream shade or habitat complexity in the future.

Thickets of sub-merchantable conifers also restrict the growth of dominant trees that are most important for woody debris recruitment and shade (USFWS, 1999).

For the reasons described above, the activities in the Proposed Federal Action are expected to maintain woody debris recruitment in all riparian areas at or near their existing rate. It is unlikely that prescribed fire would burn riparian areas hot enough to kill significant numbers of mature trees in the riparian overstory and thus increase the rate of large wood recruitment.

5.2.5 Migration Barriers

The activities in the Proposed Federal Action would not create any barriers to fish movement.

Two existing fish barriers (culverts) would be removed during road decommissioning. These are (1) the FR 13462 culvert on Rombo Creek, which is a barrier to upstream movement of bull trout and westslope cutthroat trout; and (2) the FR 361 culvert on Beavertail Creek, which is a barrier to upstream movement of westslope cutthroat trout. Removing these two culvert barriers would restore access to 0.7 miles (Rombo) and 0.3 miles (Beavertail) of historic spawning and rearing habitat, respectively.

5.3 Direct and Indirect Effects

Direct effects to bull trout and their habitat would occur when the FR 13462 culvert is removed on Rombo Creek. When the culvert is removed and the road crossing is recontoured, sediment delivered by the construction activities may force a low number (likely < 5 fish) of juvenile or small resident bull trout to temporarily abandon their habitats in the first 200 m below the culvert and move further downstream to avoid harassment, intermittent pulses of turbidity, and reductions in rearing habitats and macroinvertebrate food supply due to sediment infill. An immediate benefit of the culvert removal would be the restoration of year-round access to 0.7 miles of additional spawning and rearing habitat above the crossing. Also, access to colder refugia habitat would increase, which is important in light of climate change.

The abandonment of habitat caused by the culvert removal would have indirect effects on the low numbers of bull trout that are forced to move further downstream. These may include behavioral changes such as reduced feeding efficiency and growth rates, increased competition for food and prime rearing habitats, and increased physiological stress, which could last for several days to as long as one year. The combination of these factors increases the likelihood of mortality, particularly for the young-of-the-year and juvenile life stages. Scattered patches of suitable spawning gravels that are located within 200 m of the culverts would also be degraded for a year or so by higher levels of fines, which could reduce egg to fry survivorship in the first 1-2 spawning classes following the culvert removal. Increasing the amount of fines in spawning habitats has been shown to reduce egg to fry survivorship rates for salmonid fishes (Bjornn and Reiser, 1991; Chapman, 1988; Everest et al. 1987), including bull trout (see authors cited in Rieman and McIntyre, 1993).

Indirect effects to bull trout and their habitat could also occur in portions of the Nez Perce Fork, Rombo Creek, Blue Joint Creek, and the Little West Fork as a result of log hauling. Log truck traffic would increase erosion on the surfaces of the haul roads, which in turn increases the risk of sediment delivery at road stream crossings and along near-stream road segments. With proper application and maintenance of BMP's, the amount of sediment that hauling delivers into bull trout habitat is predicted to be less than what the existing traffic load is currently delivering (Table 13). It is expected that any sediment that is delivered by hauling would be too small in quantity and widely dispersed in area for us to be able to detect and measure effects on bull trout individuals and habitat.

In the Nez Perce Fork and Rombo Creek, hauling could deliver small amounts of sediment into bull trout spawning and rearing habitats that are currently considered to be in adverse condition (FUR) for *Sediment* and *Substrate Embeddedness*. The two affected reaches are: (1) the portion of the Nez Perce Fork between Two and Flat creeks (3.2 mile section of SR critical habitat); and (2) the Bitterroot NF portion of Rombo Creek (2.5 mile section of occupied spawning and rearing habitat). With proper installation and maintenance of BMP's, the amount of sediment that hauling delivers is likely to be too small and scattered to result in measurable effects to bull trout individuals and habitat. Over time, the BMP's should result in gradual improvements in the quality of bull trout spawning and rearing habitat in the Nez Perce Fork and Rombo Creek.

Sediment levels are low in the action area portion of the West Fork Bitterroot River (Figure 17). Also, with the exception of the Nez Perce Fork, the other tributaries that enter the river in the action area only account for a tiny fraction of the West Fork's annual discharge and sediment load. Therefore, any project-derived sediment that makes its way into bull trout critical habitat in the West Fork is expected to be too small and widely dispersed/diluted to have a detectable effect on bull trout individuals or habitat.

By keeping watershed ECAs below 20%, potential increases in stream flows resulting from reductions in forest canopy cover are anticipated to be too small to cause accelerated bank erosion, changes in stream channel dimensions and stability, and increased sediment delivery.

Adherence to the design features for herbicide spraying is expected to keep active ingredient concentrations in streams at levels that are too small to detect, and too small to have measurable effects on bull trout. Herbicides would only be applied at concentrations that are calculated to be lower than the MATC levels for rainbow trout and/or cutthroat trout documented in risk assessments (USDA Forest Service, 2011). At concentrations lower than the MATC, bull trout populations are likely to be reasonably protected; certain individuals may still react to the herbicide but the overall population is considered safe (Mayer and Ellersieck 1986).

5.4 Cumulative Effects

Cumulative effects for consultation under the ESA are the combined effects of the Proposed Federal Action and any future State, County, or private activities - not involving Federal activities - that are reasonably certain to occur within the action area and overlap with the Proposed Federal Action in space or time [50 CFR §402.02]. This definition applies only to ESA consultation and should not be confused with the broader use of this term in the National Environmental Policy Act (NEPA) or other environmental laws.

The only fish habitat components that are likely to be affected by the Proposed Federal Action are sediment and water chemistry. The other habitat components such as water temperature, wood recruitment, habitat structure and complexity, and creation of passage barriers are unlikely to be affected by project activities because of the protection afforded by RHCAs and the project design features. Therefore, this cumulative effects analysis focuses on (1) past, ongoing, and reasonably foreseeable activities that could potentially deliver sediment to streams and overlap in space and time with sediment delivered by the Proposed Federal Action; and (2) past, ongoing and reasonably foreseeable applications of herbicides that could potentially overlap in space and time with applications that occur as part of the Proposed Federal Action. Because there are likely to be no cumulative effects on the other aquatic habitat components, they are not further analyzed or discussed in this report.

Cumulative Effects Analysis Area

The cumulative effects analysis area consists of the action area plus another 1,100 or so acres of private lands that border the action area along the lower Nez Perce Fork and lower Boulder Creek. Only the portions of the West Fork Bitterroot River that lie within the action area were considered for cumulative effects; the portions of the river that are located upstream of Painted Rocks Dam and downstream of Troy Creek were not considered for cumulative effects because those portions of the river are too far away to have any meaningful overlap with sediment delivered by the Proposed Federal Action.

State Activities

The only State land that is present in the cumulative effects analysis area is 166 acres surrounding Painted Rocks Dam and Reservoir. The State land is managed by the Montana Department of Natural Resources and Conservation (DNRC), which is the agency that operates and maintains Painted Rocks Dam and Reservoir.

There are two ongoing and reasonably foreseeable projects planned for State lands that would deliver sediment to the cumulative effects analysis area portion of the West Fork Bitterroot River (described below). These two projects are likely to overlap in space and time with sediment delivered by the Proposed Federal Action.

(1) DNRC has recently completed an informal ESA consultation with the U.S. Fish and Wildlife Service for a project that would construct a new bridge over the West Fork Bitterroot River about a quarter mile below Painted Rocks Dam, and reconstruct/upgrade about 2,350 feet of primitive road that would connect the new bridge to the base of the dam. The new bridge would likely consist of a pre-manufactured steel truss bridge that would span 120 feet of the river. Construction of the new bridge and improved access road is scheduled to occur in autumn, 2021. The new bridge and access road should be completed by at least one year before any of the activities in the Proposed Federal Action commence.

(2) Once the new bridge and access road is completed, a major reconstruction project at Painted Rocks Dam is likely to occur in the future. The dam is old and in need of substantial repairs and upgrades. There are no specific details concerning reconstruction plans at this time, but the timing of the repairs/upgrades could occur at the same time that the activities in the Proposed Federal Action are occurring.

To summarize, the new bridge construction, the dam repairs/upgrades, and the Proposed Federal Action are all expected to deliver some sediment to the portion of the West Fork Bitterroot River below the dam. This overlap of sediment in space and time could produce a cumulative effect.

Once projects (1) and (2) have been completed, the day-to-day routine operations of Painted Rocks Dam would continue to affect river flows and temperatures in the West Fork below the dam, but would not produce sediment or result in increased amounts of sediment being released from Painted Rocks Reservoir. The reservoir would continue to function as a large sediment trap.

County Activities

Ravalli County activities in the cumulative effects analysis area consist of maintenance of the West Fork Highway and the paved portion of the Nez Perce Road (FR 468). The County's primary maintenance activities are snow plowing, traction sanding, and chemical de-icing in winter. Maintenance activities outside of winter (e.g. asphalt patching, sign and reflector post repairs/replacements, guardrail repair, line painting, ditch mowing, herbicide spraying along the edges of the highway) also occur, but on a smaller scale and less frequently.

In 2009-11, the County conducted a major clearing of trees from the West Fork Highway right-of-way. Since then, the only vegetation work that the County has conducted in the right-of-way has been periodic ditch mowing and mastication of small trees and shrubs that are attempting to recolonize the inner portion of the right-of-way closest to the highway. In the outer half of the right-of-way, numerous conifer and deciduous saplings are robustly growing back in the areas that were previously cleared.

Ravalli County sprays herbicides along the edges of the West Fork Highway (eight feet from the edge of the asphalt) about every 2-3 years. The last application occurred in the summer of 2020. The end use product applied was Opensight, which is a blend of aminopyralid and metsulfuron-methyl. Opensight is classified as having low toxicity to fish and aquatic invertebrates. The 2020 application is expected to have some residual effects through the summer of 2021, but be completely broken down by the summer of 2022. Spot spraying of patches of new invaders such as hoary alyssum or kochia could occur in summer 2021 or 2022 if those plants are detected.

Within the cumulative effects analysis area, about 2.7 miles of the West Fork Highway is located within 100 feet of the West Fork Bitterroot River and its tributary crossings, and about 0.4 miles of FR 468 is located within 100 feet of the Nez Perce Fork and its tributary crossings. These near-stream road segments are the areas where County snow plowing and traction sanding likely delivers some sediment to the cumulative effects analysis area portions of the West Fork Bitterroot River, Nez Perce Fork, and their tributaries. The Bitterroot Headwaters TMDL estimated that snow plowing and traction sanding delivers an estimated 0.624 tons of sand to the West Fork Bitterroot River per year (MDEQ, 2005: pg 153). An estimated 70% of that quantity (or 0.44 tons) could potentially be delivered to the cumulative effects analysis area portion of the West Fork in any given winter. Table 14 displays the annual sediment load of the West Fork Bitterroot River that was estimated by MDEQ in the Bitterroot Headwaters TMDL (MDEQ, 2005; pgs 180-182).

Table 14. Estimated Annual Sediment Load (tons/year) of the West Fork Bitterroot River (MDEQ, 2005: pgs 181-182)

Natural	Forest Roads	Timber Harvest	Fires of 2000[/1]	Traction Sanding	Total excluding the Fires of 2000
9,473	3,041	8.5	19,220	0.624	12,523.12

[/1] = the estimated sediment delivery from the 2000 fires is shown here for reference. It is currently thought to be near zero. Since 2000, several wildfires have delivered large quantities of sediment to the West Fork. Nearly all of this delivery has occurred in portions of the West Fork that are outside of the cumulative effects analysis area. For example, the sediment produced by the 2000 fires was mostly delivered to areas upstream of Painted Rocks Dam; very little delivery occurred in portions of the river downstream of the dam. The 2011 Saddle Complex and 2012 Mustang Complex fires delivered their sediment to the upper reaches of the West Fork, well upstream of Painted Rocks Dam. The 2007 Rombo fire delivered the majority of its sediment to Painted Rocks Reservoir via Little Boulder Creek, and to the portion of the West Fork below the mouth of Piquett Creek. Both of these areas are outside of the cumulative effects analysis area. The only delivery that occurred within the cumulative effects analysis area was via Rombo Creek, and because Rombo Creek has a minimal overland connection to the West Fork, very little of the Rombo fire-generated sediment was able to enter the cumulative effects analysis area portion of the West Fork. At present, most of the sediment produced by fires over the past two decades is either sitting on the bottom of Painted Rocks Reservoir, or in storage in low velocity habitats in the West Fork above the reservoir. None of the fires are currently delivering significant quantities of sediment to the West Fork. Their burned areas have sufficiently re-vegetated to the point that hillslope erosion and sediment delivery rates are near pre-fire conditions.

As shown in Table 14, traction sanding contributes a miniscule fraction of the West Fork's estimated annual natural sediment load (0.00007%) and total annual sediment load (0.00005%). Also, most of the traction sand is delivered to the portion of the river that is considered to be "sediment starved", which is the portion between Painted Rocks Dam and Conner.

To summarize, County snow plowing and traction sanding delivers relatively small quantities of sediment to the cumulative effects analysis area portions of the West Fork, Nez Perce Fork, and their tributaries that are crossed by those roads. This sediment delivery would overlap in space and time with sediment delivered by the Proposed Federal Action, and thus could combine to produce a cumulative effect.

Herbicide spraying along the West Fork Highway last occurred in summer 2020. The next application is scheduled to occur in summer 2022 or 2023. Spot spraying of patches of new invaders could occur every summer. The end use product that is being applied is Opensight, which is a blend of aminopyralid and metsulfuron-methyl. Aminopyralid is active in the soil for about 210 days (half-life averages 103 days) before it breaks down into inert elements, and metsulfuron-methyl for about 60 days (half-life averages 7-28 days). The soonest that any herbicides could be sprayed in the Proposed Federal Action would be the summer of 2023 at the very earliest. Given the break down rates of the active ingredients, all of the herbicides that the County has sprayed along the highway up to the present time would be broken down (i.e. inert) by the time any applications could occur in the Proposed Federal Action. Any herbicides applied by the County in the future, however, would have potential to overlap in time (but would not overlap spatially) with the herbicide applications in the Proposed Federal Action and combine to produce a cumulative effect.

Private Activities

The amount of private land in the cumulative effects analysis area is relatively small (about 3,000 acres), accounting for about 6% of the total acreage of the area. About 1,897 acres of private land are located within the action area; the other 1,100 or so acres border the action area along the lower Nez Perce Fork and lower Boulder Creek. Private lands are concentrated along the valley bottoms surrounding the West Fork Bitterroot River, the West Fork Highway, and the lower four miles of the Nez Perce Fork. They consist of a mix of home sites and pastures. Roughly half of the homes are occupied by year-round residents; the remainder are summer homes. The majority of the private lands are forested. Access to the private lands is provided via the West Fork Highway and the Nez Perce Road (FR 468).

Activities that occur on the private lands include home and outbuilding maintenance, a limited amount of new construction, raising a few hobby horses, watering lawns and gardens, miscellaneous recreation

activities including fishing, floating, and riding OHVs, and maintenance of access roads and driveways. A limited amount of irrigated hay production occurs in pastures bordering the Nez Perce Road. Compared to what occurs elsewhere in the Bitterroot Valley, the amount of acreage that is irrigated is very small.

Residential roads are widely dispersed across private lands in the cumulative effects analysis area, and some closely approach or cross the West Fork, Nez Perce Fork, or their tributaries. Maintenance of these roads predominantly consists of snow plowing and periodic grading, and is the responsibility of the individual homeowners or homeowners associations. Use of chemical dust abatement does not occur on a large scale. The quality of the grading and snow plowing varies widely, and in worst-case scenarios can result in some sediment delivery to the river and its tributaries. The periods of highest delivery usually occur during rain-on-snow events and especially during spring break-up in heavy snow years. Because of their valley bottom locations, the majority of the roads on private lands are flat, which limits their potential to deliver sediment to streams. There is likely to be a minimal amount of new road construction in the reasonably foreseeable future. The majority of the private lands are already developed with few parcels remaining in an undeveloped condition.

There are other private activities in the action area (in particular, float angling on the West Fork Bitterroot River) that are adversely impacting habitat features such as large wood and habitat complexity. However, because those activities are not producing or delivering sediment to bull trout habitat, they have no potential to overlap in space and time with the effects from the Proposed Federal Action and are not discussed further in this BA/BE. Only the state, county, and private activities that could potentially deliver sediment are analyzed for cumulative effects in this BA/BE.

To summarize, activities on private lands deliver small quantities of sediment to the cumulative effects analysis area portions of the West Fork, Nez Perce Fork, and the lower ends of their tributaries that cross private lands. This sediment delivery would overlap in space and time with sediment delivered by the Proposed Federal Action, and thus could combine to produce a cumulative effect.

Herbicide applications on private lands are believed to be incidental and small-scale, usually associated with lawns (2,4-D products) or control of nuisance weeds in residential settings (glyphosate/Round-Up). No large-scale applications are known to have occurred in the past or are known to be planned for the future. The active ingredients that are most likely applied on private lands are those that can be purchased over the counter without an applicators license (e.g. aminopyralid, 2,4-D, glyphosate). These ingredients are generally classified as low risk to aquatic organisms provided that label directions are followed.

Table 15 lists the relevant sediment-producing State, County, and private activities and their potential to combine with the Proposed Federal Action to have a cumulative effect on fish and their habitat.

Table 15. Summary of State, County, and Private Activities and their Potential for Cumulative Effects.

STATE, COUNTY, OR PRIVATE ACTIVITY	EXTENT	INTENSITY AND DURATION	POTENTIAL CUMULATIVE EFFECT WITH THE PROPOSED FEDERAL ACTION
Construction of the new bridge and access road below Painted Rocks Dam (DNRC)	Bridge construction activities are predicted to deliver measurable amounts of sediment in small patches where excavation occurs for the bridge abutments. It is unlikely that deposits of sediment would be visible in the river bottom more than 600 feet below the construction site. Beyond 600 feet, sediment delivered by the project is expected to be too small to be seen, measured, or to meaningfully evaluate effects. Short bursts of turbid water may periodically occur > 600 feet below the construction site when excavation is occurring. The turbid water is unlikely to last for more than an hour or so.	Intensity: High while construction is occurring, but effects would be restricted to the immediate construction site and the first 600 feet of river below the construction site. Duration: 3-4 weeks in the autumn (late September – early November) 2021 when water releases from the reservoir have been shut off for the winter.	The DNRC bridge project is likely to be completed for at least a year before the Proposed Federal Action commences, and possibly closer to two years. With that much time elapsing between projects, the cumulative effect of combining Mud Creek sediment with DNRC bridge sediment would be insignificant (i.e. too small to meaningfully evaluate effects on fish and fish habitat). The degree of overlap where potential deposition could occur would also be minimal. DNRC bridge sediment is likely to be confined to very near the construction site, while sediment delivered by the Proposed Federal Action (insignificant quantities) is likely to enter the river further downstream below Mud Creek.
Reconstruction and upgrade of Painted Rocks Dam (DNRC)	Without specific project details it is impossible to accurately predict how much sediment the dam reconstruction activities will deliver to the West Fork, or the downstream extent of deposition that occurs in the river bottom. This project is likely to deliver more sediment to the West Fork than the DNRC bridge project, but the point of delivery will be further upstream than the DNRC bridge project, and thus greater distance away from potential combination with Mud Creek sediment.	Intensity: High. Duration: Unknown. Probably at least a month of construction/excavation. Likely to occur sometime between late September into early November when water releases from the reservoir have been shut off for the winter.	With erosion control mitigation features, and by excavating during a time of year when much of the dirt-moving work can be done on dry ground, it is expected that direct sediment deposition created by the dam reconstruction activities would be restricted to portions of the river bottom within the first 0.25 miles of river immediately below the dam. There would be no overlap with Mud Creek sediment in that area. Overlap would occur when the construction-generated sediment is indirectly transported further downstream during high flow events. That process would widely scatter and dilute the sediment to the point where it would not be detectable. Since none of the tributaries to the West Fork are likely to deliver any significant quantities of sediment to the river as a result of Mud Creek activities, the degree of overlap in Dam-generated sediment and Mud Creek sediment is expected to be minimal, with insignificant effects on fish and fish habitat.
Operation of Painted Rocks Dam (DNRC)	Once the reconstruction projects have been completed at Painted Rocks Dam, the day-to-day operations of the dam would continue to affect river flows and temperatures in the West Fork below the dam (similar to what is currently occurring). However, the routine operations of the dam would not increase the amounts of sediment being released into the West Fork Bitterroot River from Painted Rocks Reservoir.	Intensity: Low. Duration: None. Routine operations of the dam would not increase the amount of sediment that comes out of Painted Rocks Reservoir and enters the West Fork Bitterroot River below the dam.	The routine operations of Painted Rocks Dam is not expected to increase the amounts of sediment that are released from Painted Rocks Reservoir. The reservoir would continue to function as a large sediment trap and contribute to the sediment-starved condition that currently exists below the dam. Reservoir operations would have no cumulative effects with the activities in the Proposed Federal Action.

STATE, COUNTY, OR PRIVATE ACTIVITY	EXTENT	INTENSITY AND DURATION	POTENTIAL CUMULATIVE EFFECT WITH THE PROPOSED FEDERAL ACTION
Snow plowing and traction sanding (Ravalli County)	The Ravalli County Road and Bridge Department plows and sands all of the West Fork Highway and the lower four miles of the Nez Perce Road (FR 468) in the cumulative effects analysis area. The points of delivery where traction sand could potentially be sidecast into streams are the portions of the West Fork Highway and FR 468 that are located within 100 feet of the river and the Nez Perce Fork, and their tributary crossings. These potential delivery points total about 2.7 miles of the West Fork Highway in the cumulative effects analysis area, and about 0.4 miles of FR 468.	Intensity: Low. The amount of sand that is sidecast into the West Fork, Nez Perce Fork, and its tributaries is small during any one plowing session. Over the course of one winter, Ravalli County applies about one ton of sand per mile of highway. Duration: Varies by winter, but is chronic. A small amount of sediment delivery occurs along the edges of the West Fork and Nez Perce Fork in a few spots every time the roads are plowed. Over the past decade, the County has plowed and sanded the West Fork Highway and FR 468 an average of about 35 times per winter.	In the Bitterroot Headwaters TMDL, MDEQ conservatively estimated that 10% of the traction sand applied within 100 feet of streams made it into water bodies, and 5% applied between 100 and 200 feet of streams made it into water bodies (MT DEQ, 2005: pg 153). Using those assumptions (which were intentionally designed to be somewhat high), the total delivery to the West Fork Bitterroot River was estimated to be 0.624 tons per year, which is still only 0.0007% of the natural background sediment load of the river. The degree of overlap between snow plowing-generated sediment and Mud Creek sediment is expected to be minimal. Snow plowing sediment generally occurs along the edges of rip-rapped banks where the highway is very close to the river; Mud Creek sediment could only get into the river via small tributaries that are protected with intact RHCAs. Neither locations have much overlap. The combined effect of both sources of sediment is likely to be too small to be able to detect any effects on fish and fish habitat quality in the West Fork and Nez Perce Fork.
Sediment-producing activities on private lands	In the cumulative effects analysis area, approximately 70 homes (which include access roads, driveways, and outbuildings) are located within 300 feet of perennial streams. Most occur near the West Fork Bitterroot River (35), followed by the Nez Perce Fork (13), lower Boulder Creek (7), lower Nelson Creek (5), lower Mud Creek (4), lower Buck Creek (4), and lower Beavertail Creek (2). Sediment delivery caused by residential development is usually contributed by roads. However, when residential development results in riparian vegetation being cleared from the stream banks, the banks become less stable and more prone to erosion at high flows, which increases sediment delivery. There are short, spotty sections of stream bank along the West Fork and Nez Perce Fork where this is occurring.	Intensity: Low. The majority of the private homes and access roads are located in areas where they are unlikely to deliver measurable quantities of sediment to the West Fork or its tributaries (e.g. flat, well-vegetated ground > 100 feet from the edges of streams; on high and dry terraces). The majority of erosive banks have been rip-rapped, which reduces their sediment delivery potential. Duration: Sediment delivery from private lands is generally at its highest during spring break-up and high flows. It is much lower during the other times of the year.	The degree of overlap between private land-generated sediment and Mud Creek sediment is expected to be minimal. The combined contribution from both sources is expected to be too small to be measured or meaningfully evaluated. The water bodies where overlap is mostly likely to occur would be the West Fork Bitterroot River and the lower four miles of the Nez Perce Fork. Both of these water bodies are large streams with natural background sediment loads that far exceed the combined sediment delivery from private land activities and the Proposed Federal Action. The combined effect would be too small to be able to detect and evaluate any effects on fish and fish habitat quality in the West Fork and Nez Perce Fork.

STATE, COUNTY, OR PRIVATE ACTIVITY	EXTENT	INTENSITY AND DURATION	POTENTIAL CUMULATIVE EFFECT WITH THE PROPOSED FEDERAL ACTION
Herbicide applications (Ravalli County and private lands)	The Ravalli County Weed Department sprays the edges of the West Fork Highway (eight feet from the edge of the asphalt) with herbicides every 2-3 years. About 10 miles of the highway occurs within the cumulative effects analysis area. More than 100 homes (including access roads, driveways, and outbuildings) are located on private lands in the cumulative effects analysis area. About 70 of these homes are located within 300 feet of perennial streams. About half occur near the West Fork Bitterroot River.	Intensity: Low. The County last sprayed herbicides along the edges of the West Fork Highway in summer 2020. The next application is scheduled to occur in summer 2022 or 2023. Spot spraying of patches of new invaders could occur every summer. The end use product that is being applied is Opensight, which is a blend of aminopyralid and metsulfuron-methyl. It is classified as having low toxicity to fish and aquatic invertebrates. Herbicide applications on private lands appear to be small-scale and incidental. Over the counter active ingredients (aminopyralid, glyphosate, 2,4-D) are likely the most commonly applied herbicides on private lands. These ingredients generally have low toxicity to fish and aquatic invertebrates provided they are applied according to label direction. Duration: The active ingredients that are being applied on County and private lands have low to moderate persistence in the soil. Aminopyralid is active in the soil for about 210 days (half-life averages 103 days) before it breaks down into inert elements, and metsulfuron-methyl for about 60 days (half-life averages 7-28 days). 2,4-D is active in the soil for about 20 days (half-life averages 10 days), and glyphosate for about 96 days (half-life averages 47 days). Because persistence is relatively low, the time window for potential overlap with herbicides applied in the Proposed Federal Action would be short, lasting for six months or less.	More than 15 months have elapsed since the last time (summer 2019) roadsides were sprayed on Forest Service lands in the cumulative effects analysis. In summer 2020, the only spraying that occurred on Forest Service lands was in the Fales Flat campground. The active ingredients that were applied in 2019-20 were aminopyralid and metsulfuron-methyl. The soonest that any herbicides could be sprayed in the Proposed Federal Action would be the summer of 2023 at the very earliest. Given the break down rates of the active ingredients, all of the herbicides that were sprayed on Forest Service lands in 2019-20 would be inert (i.e. no longer active in the soil or water) by the time the Proposed Federal Action applications occur. The last time Ravalli County sprayed the edges of the West Fork Highway was in the summer of 2020. The 2020 application is expected to have some residual effects through the summer of 2021, but be completely broken down by the summer of 2022. The over the counter active ingredients that are mostly commonly used on private lands have short half-lives. Therefore, all chemicals applied on private lands in the past are likely to be inert at this time. There are no ongoing applications of herbicides on any ownerships that we are aware of, and as explained above, all of the past applications would be inert by the time any applications occur in the Proposed Federal Action. Therefore, only future applications of herbicides are considered to have potential to contribute cumulative effects. The herbicide applications that occur as part of the Proposed Federal Action could overlap in time (but not spatially) with applications that occur along the West Fork Highway and on private lands. By design feature, all sources of herbicides (Ravalli County + private lands + Forest Service roadside spraying + the spraying in the Proposed Federal Action) must be included in the calculations to determine how many acres can be sprayed per sub-watershed per year to stay under the MATC level. Keeping cumulative active ingredient concentrations in streams under MATC levels is the key to this cumulative effects analysis. As long as that is done, herbicide applications are expected to have insignificant cumulative effects on aquatic species (Mayer and Ellersieck 1986). The MATC method is comparable to methods used in risk assessments conducted by the Forest Service and complies with directions outlined in Forest Service Manual FSM 2900 (2011).

Cumulative Effects (ESA)
Sediment is the primary cumulative effect concern from the Proposed Federal Action.

The sediment produced by the State, County and private activities in Table 15 has the potential to overlap in space and time with the sediment produced by the Proposed Federal Action. The extent of the overlap, both in terms of the length of fish habitat affected and the time that overlap occurs, is likely to be limited in scope and small in scale.

The areas where overlap could potentially occur would be:

1. small, widely scattered patches of rearing habitat in the West Fork Bitterroot River near the mouths of the following tributaries: Mud, Bonnie Blue, Rombo, Ditch, and Beavertail creeks. The confluences of these tributaries are small (< 5 feet wetted width) and thus have very limited potential to deliver sediment to the West Fork; and
2. private land segments of the Nez Perce Fork that are within 50 feet of houses or the Nez Perce Road (FR 468).

Both the West Fork Bitterroot River and the Nez Perce Fork are large streams with natural background sediment loads that are magnitudes higher than the total combined sediment contributions that could occur from the State, County, and private activities and the Proposed Federal Action. The West Fork Bitterroot River and Nez Perce Fork also have high scouring power and are efficient at transporting and routing sediment downstream. As a result, it is unlikely that sediment would be able to accumulate in any one spot to the degree needed to adversely affect fish habitat over the multiple years that the Proposed Federal Action would be active. Each annual high flow event would clean out and widely scatter any minor sediment deposits that occurred during the previous year. In no area would sediment be likely to accumulate to the point that it could have a detectable or measurable effect on fish habitat quality. For those reasons, any ESA cumulative effects that occur as a result of the Proposed Federal Action are likely to be insignificant (i.e. too small to measure or meaningfully evaluate).

Cumulative Effects (NEPA)
As previously stated, the ESA definition of cumulative effects is different than the NEPA definition of cumulative effects. ESA cumulative effects only considers the effects of future State, County, or private activities – not Federal activities. NEPA cumulative effects, however, considers the effects of all past, ongoing, or reasonably foreseeable activities regardless of ownership. The activities relevant to NEPA cumulative effects are not listed in this BA/BE, but can be found in the Mud Creek Aquatic Specialist Report.

Rombo Creek is the one stream in the action area where a cumulative effect may occur to bull trout and bull trout habitat as a result of the Proposed Federal Action. The spawning and rearing habitat in Rombo Creek is already impaired by high sediment, and any additional inputs that occur as a result of removing the FR 13462 culvert, and possibly from log hauling, would overlap in space and time with the existing high levels of sediment. The area of concern would be the first 1,000 feet or so of Rombo Creek immediately below the FR 13462 crossing. In that area, the overlap of existing high sediment levels plus increases produced by removing the FR 13462 culvert plus any small increases delivered by log hauling could reduce egg and juvenile survivorship in 1-3 spawning classes of bull trout. Bull trout are rare (< 20 fish) in the affected area, so the extent of negative short-term effects on the Rombo Creek population would be limited.

Starting about a year after the FR 13462 culvert has been removed, the quality of bull trout spawning and rearing habitat in Rombo Creek should start to gradually improve as a result of the road decommissioning and storage treatments and the BMP upgrades. Particularly beneficial would be the storage of FR 13462. Removing the FR 13462 culvert would allow year-round access to an additional 0.7 miles of historic spawning and rearing habitat. This would be beneficial to the health and persistence of the Rombo Creek bull trout population in the long-term.

Elsewhere in the action area, cumulative effects to bull trout and bull trout habitat are expected to be insignificant.

The herbicide applications that occur as part of the Proposed Federal Action could overlap in time (but not spatially) with future herbicides applied by Ravalli County along the West Fork Highway, any known

applications on private lands, and future roadside applications on Forest Service lands. The authorized roads in the Mud Creek project area (22 roads) were last sprayed in summers 2018 and 2019 and are not scheduled to be sprayed again until 2022 and 2023. The edges of the West Fork Highway were last sprayed by Ravalli County in summer 2020 and are scheduled to be sprayed again in 2022 or 2023. Spot spraying of patches of new invaders could occur in any summer. Future applications on private lands are unknown but are assumed to remain at or near current incidental use levels.

By design feature, all sources of herbicides (Ravalli County + any known private sources + Forest Service roadside spraying + the spraying in the Proposed Federal Action) must be combined in the calculations to determine how many acres can be sprayed per sub-watershed per year in the Proposed Federal Action to stay under the MATC level. Keeping cumulative active ingredient concentrations in streams under MATC levels is the key to this cumulative effects analysis. As long as that is done, herbicide applications are expected to have insignificant cumulative effects on bull trout individuals and populations (Mayer and Ellersieck 1986).

The Montana Bull Trout Scientific Group (1995) identified stream dewatering and non-native fish as the two highest risks to bull trout in the Bitterroot River basin. Stream dewatering has a negligible impact on fish habitat in the action area, while non-native fish have a major impact, particularly in the West Fork Bitterroot River and Nez Perce Fork. That being said, neither dewatering nor non-native fish produce sediment; therefore, they would not contribute any cumulative effects in the action area. The activities in the Proposed Federal Action would not reduce stream flows exiting National Forest lands, nor are they expected to create habitat conditions that favor non-native trout over native trout.

5.5 Predicted Effects to Matrix Indicators

The following changes are predicted to occur to the functional levels of the baseline indicators (Table 16).

HUC 0106, Lower Blue Joint Creek

Indicator: **Sediment**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor degrade. The activities in the Proposed Federal Action are expected to contribute insignificant amounts of sediment to bull trout habitat in HUC 0106. The amount of sediment that is delivered to streams would be too small to change the functional rating.

Indicator: **Drainage Network Increase**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor restore. Decommissioning 18.42 miles of road and storing 0.4 miles would reduce the drainage network in HUC 0106. The overall reduction in road miles that occurs in HUC 0106 as a result of the Proposed Federal Action would not be large enough to change the functional rating.

Indicator: **Road Density & Location**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor restore. As a result of the Proposed Federal Action, the road density in HUC 0106 would decrease from 8.88 miles/mile^2 to 7.56 miles/mile^2. The miles of road located within 300 feet of streams would decrease by 6.34 miles, and the number of stream crossings in the HUC would decrease by 16 crossings. These decreases would not be large enough to change the functional rating.

Indicator: **Riparian Conservation Area**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor restore. Sixteen stream crossing culverts would be removed in HUC 0106 and about 1.61 miles of road would be decommissioned within 300 feet of streams. The riparian improvements that occur in the future in these areas would not be large enough to change the functional rating at the 6th level HUC scale.

HUC 0108, West Fork Bitterroot River-Painted Rocks Lake

Indicator: **Drainage Network Increase**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor restore. Decommissioning 0.75 miles of road would slightly reduce the drainage network in HUC 0108. It is not enough to significantly reduce the overall road density in the HUC, and the reduction would not be large enough to change the functional rating.

HUC 0203, Little West Fork

Indicator: **Sediment**
Pre-project rating: FA
Post-project rating: FA
Effect of project on rating: Minor degrade. The activities in the Proposed Federal Action are expected to contribute insignificant amounts of sediment to bull trout habitat in HUC 0203. The amount of sediment that is delivered to streams would be too small to change the functional rating.

Indicator: **Drainage Network Increase**
Pre-project rating: FA
Post-project rating: FA
Effect of project on rating: Minor restore. Decommissioning 1.82 miles of road and storing 1.12 miles would reduce the drainage network in HUC 0203, and offset the construction of 0.88 miles of new specified roads. The overall reduction in road miles that occurs in HUC 0203 as a result of the Proposed Federal Action would not be large enough to change the functional rating.

Indicator: **Riparian Conservation Area**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor restore. Three stream crossing culverts would be removed in HUC 0203. The riparian improvements that occur in the future in these areas would not be large enough to change the functional rating at the 6th level HUC scale.

HUC 0204, Nez Perce Fork

Indicator: **Sediment**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor degrade. BMP's are predicted to reduce sediment delivery from the near-stream segments of FR 468, even with log hauling traffic (Table 13). However, hauling as many as 2,000 log truck loads on the near-stream segments of FR 468 poses a risk of sediment delivery to a section

of the Nez Perce Fork that is currently considered to be adverse for sediment, thus the need for the "minor degrade" rating.

Indicator: **Substrate Embeddedness**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor degrade. Same rationale as the sediment indicator.

Indicator: **Pool Frequency and Quality**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor degrade. Hauling as many as 2,000 log truck loads on the near-stream segments of FR 468 poses a risk for delivering sediment to pools. That is the reason for the "minor degrade" rating. Any changes in pool habitat that occur as a result of the Proposed Federal action would be too small to change the functional rating at the 6th level HUC scale.

Indicator: **Drainage Network Increase**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor restore. Decommissioning 7.21 miles of road and storing 8.02 miles would reduce the drainage network in HUC 0204, and offset the construction of 3.97 miles of new specified roads. The overall reduction in road miles that occurs in HUC 0204 as a result of the Proposed Federal Action would not be large enough to change the functional rating.

Indicator: **Road Density & Location**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor restore. As a result of the Proposed Federal Action, the road density in HUC 0204 would decrease slightly from 3.75 miles/mile^2 to 3.63 miles/mile^2. The miles of road located within 300 feet of streams would decrease by 2.42 miles, and the number of stream crossings in the HUC would decrease by four crossings. These decreases would not be large enough to change the functional rating. The BMP upgrades on FR 468 are expected to reduce long-term sediment delivery from its near-stream segments after log hauling has been completed.

Indicator: **Riparian Conservation Area**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor restore. Four stream crossing culverts would be removed in HUC 0204 and about 1.04 miles of road would be decommissioned within 300 feet of streams. The riparian improvements that occur in these areas would not be large enough to change the functional rating at the 6th level HUC scale.

HUC 0301, West Fork Bitterroot River-Rombo Creek

Indicator: **Sediment**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor degrade. Removing the FR 13462 culvert would increase sediment delivery to the portion of Rombo Creek immediately below the road crossing. Log hauling also has potential to deliver small amounts of sediment to Rombo Creek. Any sediment increases that occur as a result of removing the FR 13462 culvert and log hauling would be short-term and too small to change the functional rating at the 6th level HUC scale.

Indicator: **Physical Barriers**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor restore. Two existing fish culvert barriers in HUC 0301 would be removed: (1) the FR 13462 culvert on Rombo Creek and (2) the FR 361 culvert on Beavertail Creek. Removing the FR 13462 culvert would open up year-round access to 0.7 miles of spawning and rearing habitat for bull trout and westslope cutthroat trout. Removing the FR 361 culvert would open up year-round access to 0.3 miles of spawning and rearing habitat for westslope cutthroat trout. There are still other culvert barriers remaining in HUC 0301, so the functional rating would not change.

Indicator: **Substrate Embeddedness**
Pre-project rating: FAR
Post-project rating: FAR
Effect of project on rating: Minor degrade. Same rationale as the sediment indicator.

Indicator: **Pool Frequency and Quality**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor degrade. Removing the FR 13462 culvert would increase sediment levels in pool habitats in the portion of Rombo Creek immediately below the FR 13462 crossing. Log hauling may also contribute small increases during the same time period. The increases are expected to be short-term (< 3 years), but pools in the affected portion of Rombo Creek already contain high amounts of sediment (Figure 17). The changes in pool habitat that occur as a result of the Proposed Federal Action would not be large enough, widespread enough, or of a long enough duration (about three years) to change the functional rating at the 6th level HUC scale.

Indicator: **Drainage Network Increase**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor restore. Decommissioning 12.54 miles of road and storing 6.64 miles would reduce the drainage network in HUC 0301, and offset the construction of 4.91 miles of new specified roads. The overall reduction in road miles that occurs in HUC 0301 as a result of the Proposed Federal Action would not be large enough to change the functional rating.

Indicator: **Road Density & Location**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor restore. As a result of the Proposed Federal Action, the road density in HUC 0301 would decrease slightly from 6.51 miles/mile^2 to 6.26 miles/mile^2. The miles of road located within 300 feet of streams would decrease by 2.25 miles, and the number of stream crossings in the HUC would decrease by eleven crossings (15 removals - 4 new crossings constructed). These decreases would not be large enough to change the functional rating.

Indicator: **Riparian Conservation Area**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor restore. Fifteen stream crossing culverts would be removed in HUC 0301, and four new crossings would be constructed. About 2.25 miles of road would be decommissioned within 300 feet of streams. The riparian improvements that occur in these areas would not be large enough to change the functional rating at the 6th level HUC scale.

HUC 0305, West Fork Bitterroot River-Lloyd Creek

Indicator: **Drainage Network Increase**
Pre-project rating: FUR
Post-project rating: FUR
Effect of project on rating: Minor restore. Decommissioning 0.13 miles of road would slightly reduce the drainage network in HUC 0301. It is not enough to significantly reduce the overall road density in the HUC, and the reduction would not be large enough to change the functional rating.

To summarize this section, there are three FUR indicators in the baseline that are predicted to suffer a "minor degrade" as a result of the Proposed Federal Action. They are:

1. *Sediment* in HUC 0204 (Nez Perce Fork);
2. *Substrate Embeddedness* in HUC 0204 (Nez Perce Fork); and
3. *Pool Frequency and Quality* in HUC 0301 (Rombo Creek).

The indicators that were not discussed in Section 5.5 would be maintained (Table 17).

6. Matrix Checklist

The baselines ratings in Table 15 are FA- Functioning Appropriately; FAR – Functioning at Risk; or FUR- Functioning at Unacceptable Risk.

The indicators that are predicted to experience a "minor degrade" in the baseline are highlighted in RED. The indicators expected to experience a "minor restore" are highlighted in GREEN.

Table 17. Matrix Checklist.

Diagnostic/Pathways: Indicators	*Lower Blue Joint 0106*	*WF Bitt River- Painted Rocks Lake 0108*	*Little West Fork 0203*	*Nez Perce Fork 0204*	*WF Bitt River- Rombo Cr 0301*	*WF Bitt River-Lloyd Cr 0305*
Subpopulation Characteristics:						
Subpopulation Size	FAR	FAR	FAR	FAR	FUR	FUR
Growth & Survival	FAR	FAR	FAR	FAR	FUR	FUR
Life History Diversity & Isolation	FAR	FAR	FAR	FAR	FAR	FAR
Persistence and Genetic Integrity	FAR	FAR	FAR	FAR	FUR	FUR
Water Quality						
Temperature	FAR	FAR	FAR	FUR	FAR	FUR
Sediment	FAR	FAR	FA	FUR	FAR	FAR
Chemical Contamination / Nutrients	FA	FA	FA	FA	FA	FA
Habitat Access						
Physical Barriers	FA	FAR	FA	FAR	FAR	FAR
Habitat Elements						
Substrate Embeddedness	FAR	FAR	FA	FUR	FAR	FAR
Large Woody Debris	FAR	FAR	FAR	FAR	FUR	FAR
Pool Frequency & Quality	FAR	FAR	FAR	FAR	FUR	FAR
Large Pools	FAR	FAR	FAR	FAR	FUR	FAR
Off-Channel Habitat	FUR	FAR	FAR	FUR	FUR	FUR
Refugia	FUR	FAR	FAR	FUR	FUR	FAR
Channel Condition and Dynamics						
Wetted Width/Max Depth Ratio	FAR	FA	FA	FAR	FAR	FAR
Streambank Condition	FAR	FAR	FA	FUR	FUR	FUR
Floodplain Connectivity	FUR	FAR	FAR	FUR	FUR	FUR
Flow / Hydrology						
Change in Peak/Base Flows	FUR	FAR	FA	FAR	FUR	FUR
Drainage Network Increase	FUR	FAR	FA	FAR	FUR	FUR
Watershed Conditions						
Road Density & Location	FUR	FAR	FAR	FUR	FUR	FUR
Disturbance History	FAR	FA	FA	FA	FA	FA

Riparian Conservation Area	FAR	FAR	FAR	FUR	FUR	FUR
Disturbance Regime	FAR	FAR	FA	FAR	FAR	FAR
Integration of Species & Habitat Condition	FAR	FAR	FAR	FUR	FUR	FUR

7. Compliance with the Forest Plan as amended by INFISH

On the Montana portion of the Bitterroot National Forest, the goals, objectives, and standards for fisheries are contained in two documents:

- The Bitterroot Forest Plan (USDA Forest Service, 1987: pgs II-3, II-5 to 6, II-20 to 21, III-22 to 27, III-23 to 26)
- The INFISH Decision Notice (USDA Forest Service, 1995)

INFISH amended the Bitterroot Forest Plan in August 1995. The parts of the Forest Plan and INFISH that are pertinent to the Proposed Federal Action are discussed below, along with a short summary of how the Action addresses them. It is clear that the Forest Plan and INFISH take a strong and consistent view that timber harvest impacts should be minimized in riparian areas, and when harvest does occur in riparian areas, it must be designed to maintain water quality and meet fisheries objectives.

1987 Forest Plan

The original (i.e. 1987) Bitterroot Forest Plan has yet to be revised; therefore, the 1987 Plan is still the rule of the land. The applicable parts of the 1987 Forest Plan are summarized below.

Applicable Forest-wide goals for fish are to "provide habitat to support viable populations of native and desirable non-native wildlife and fish"; "maintain habitat for the possible recovery of threatened and endangered species"; and "maintain riparian flora, fauna, water quality, and recreation activities" (USDA Forest Service, 1987: pg II-3). The Forest-wide goal for water is to "maintain soil productivity, water quality, and water quantity" (USDA Forest Service, 1987: pg II-24). The Proposed Federal Action would be consistent with the Forest-wide goals.

Applicable Forest-wide management objectives for fish are to "maintain habitat to support current populations of catchable trout"; "maintain or enhance fish habitat by maintaining riparian habitat and its potential to replace woody debris"; and "reduce sediment from existing roads…" (USDA Forest Service, 1987: pg II-5). A Forest-wide management objective for water is to "manage riparian areas to prevent adverse effects on channel stability and fish habitat" (USDA Forest Service, 1987: pg II-6). The Proposed Federal Action would be consistent with the Forest-wide management objectives.

The 1987 Forest Plan only contained three Forest-wide standards for fish. These are: (1) "cutthroat trout populations will be used as an indicator of fisheries habitat changes"; (2) "watershed project analysis will estimate the effects of sediment on fish habitat"; and (3) "the habitat needs of sensitive species…will be considered in all project planning" (USDA Forest Service, 1987: pgs II-20 and II-21). Applicable Forest-wide standards for water and soils are "…site specific water quality effects will be evaluated and control measures designed to ensure that the project will meet Forest water quality goals"; "projects that will not meet State water quality standards will be redesigned, rescheduled, or dropped" and "soil and water conservation practices will be a part of project design and implementation to ensure soil and water resource protection" (USDA Forest Service, 1987; pgs II-24 and II-25). The Proposed Federal Action would be consistent with the Forest-wide standards.

Activities in the Proposed Federal Action would occur in Management Areas (MA) 1, 2, 3a, 5, and 8a.Some of the units border MA 3b. MA 1 consists primarily of forested lands with about 84% of the lands suitable for timber harvest. MA 2 consists of big-game winter range with about 85% of the lands suitable for timber harvest. MA 3a consists of suitable timberlands that are located within visually sensitive zones

bordering major highways and roads. MA 5 consists of unroaded and semi-primitive elk security lands, including inventoried roadless areas. MA 8a consists of scattered areas of rock outcrops, grasslands, meadows, and forested subalpine habitat types. MA 3b consists of the riparian habitat 100 feet on either side of streams, or the area defined by water-influenced vegetation, whichever is greater. MA 3b lands are usually surrounded by, or are inclusions within MAs 1, 2, 3a, 5, and 8a.

There are no specific fish goals or standards for MA 1, 2, 3a, 5, and 8a lands. For MA 3b lands, one of the goals is to "manage riparian areas to maintain flora, fauna, water quality, and water-related recreation activities" (USDA Forest Service, 1987: pg III-22). Another goal is to "emphasize water and soil protection, dispersed recreation, visual quality, and old growth" (USDA Forest Service, 1987: pg III-22). And, the last goal states "roading in riparian areas will be restricted to meet water quality and fish objectives" (USDA Forest Service, 1987: pgIII-22). The Proposed Federal Action would be consistent with the MA 3b goals.

Applicable fish standards for MA 3b state "nonfisheries riparian areas will be managed to provide for old growth, woody debris recruitment…water quality, and downstream fisheries capability"; "stream channel equilibrium and downstream fisheries habitat capability will be maintained by protecting the riparian characteristics needed to naturally filter overland flows…stabilize stream channels, and provide woody debris…"; "interdisciplinary teams will analyze the effect of each project on riparian areas…" ; and "timber management activities will be programmed to meet fisheries, water quality, and wildlife objectives" (USDA Forest Service, 1987: pgs III-23 and III-24). Applicable timber standards for MA 3b state "precommercial and commercial thinning generally are not prescribed in fisheries riparian areas" and "…the preferred silvicultural system in fisheries riparian areas is individual tree or group selection harvest with cutting cycles which average 20 years…" (USDA Forest Service, 1987: pgIII-26). The Proposed Federal Action would be consistent with the MA 3b standards.

<u>INFISH</u>

INFISH (USDA Forest Service, 1995) amended the Bitterroot Forest Plan in August 1995. The INFISH amendment to the Forest Plan added 39 new standards that regulate activities in riparian areas. A completed listing of the INFISH standards can be found on pages A-6 to A-13 of the INFISH Decision Notice (USDA Forest Service, 1995). The INFISH standards that are most relevant to the Proposed Federal Action are:

TM-1 Prohibit timber harvest, including fuelwood cutting, in RHCAs, except as described below.

TM-1a: Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuelwood cutting in RHCAs only where present and future woody debris needs are met, where cutting would not retard or prevent attainment of other Riparian Management Objectives, and where adverse effects can be avoided to inland native fish. For priority watersheds, complete watershed analysis prior to salvage cutting in RHCAs.

TM-1b: Apply silvicultural practices for Riparian Habitat Conservation Areas to acquire desired vegetation characteristics where needed to attain Riparian Management Objectives. Apply silvicultural practices in a manner that does not retard attainment of Riparian Management Objectives and that avoids adverse effects on inland native fish.

The Proposed Federal Action would be consistent with INFISH standards TM-1, TM-1a, and TM-1b. Timber harvest would only occur in RHCAs in three small areas totaling about 19 acres. These areas and their consistency with standards TM-1a and TM-1b are described in a site-specific Watershed Analysis which is appended to this BA/BE (Appendix A). In the rest of the action area, timber harvest would be prohibited in RHCAs.

RF-2a Complete watershed analyses prior to construction of new roads or landings in RHCAs within priority watersheds.

The Proposed Federal Action would be consistent with INFISH standard RF-2a. The priority watersheds in the action area are HUC 0106 (Lower Blue Joint); HUC 0203 (Little West Fork); and HUC 0204 (Nez Perce Fork). New roads and landings are not proposed for construction in RHCAs in those HUCs.

RF-2b Minimize road and landing locations in RHCAs.

The Proposed Federal Action would be consistent with INFISH standard RF-2b. There would be no new roads or landings in RHCAs in the priority watersheds (HUCs 0106, 0203, and 0204). In the non-priority watersheds (HUCs 0108, 0301, and 0305), new roads and landings would be minimized in RHCAs. The Proposed Federal Action would construct about 0.8 miles of new specified road in RHCAs. The bulk of this would occur at four new stream crossings of non-fish bearing intermittent and perennial streams in non-bull trout watersheds. All landings in the project must comply with the following design feature:

- *Log landings will be located outside of RHCAs. Exceptions may be granted for previously used landings or natural openings that are located within RHCAs. These sites will not be used for landings until field reviewed and approved by the fisheries biologist or hydrologist.*

Adherence to this design feature would ensure compliance with INFISH standard RF-2b.

RF-2c Develop and implement a road management plan or transportation management plan.

The Proposed Federal Action would be consistent with INFISH standard RF-2c. Road management plans would be developed and implemented for any new specified roads that are constructed. Existing roads already have road management plans.

RF-2d Avoid sediment delivery to streams from the road surface.

The Proposed Federal Action would be consistent with INFISH standard RF-2d. See the design features listed in Appendix B. Any new specified roads that are constructed would incorporate the most current BMPs to minimize erosion and sediment production. Also, after being used for a timber sale, the new specified roads would be closed year-round to full-size vehicle use. On existing roads, project-related traffic, particularly log hauling operations, would be monitored by the TSA or resource specialists to ensure that roads are not contributing sediment to streams. The near-stream haul road segments would be graveled and BMP upgraded prior to hauling logs on them. Hauling will cease and other project-related traffic will be regulated during wet periods to protect roads from damage and reduce the potential for erosion and sediment delivery. Temporary roads would be located outside of RHCAs and are likely to be present on the landscape for 1-3 years before being recontoured, seeded, and straw mulched.

RF-2e Avoid disruption of natural hydrologic flow paths.

The Proposed Federal Action would be consistent with INFISH standard RF-2e. There would be no new roads in RHCAs in the priority watersheds (HUCs 0106, 0203, and 0204). In the non-priority watersheds (HUCs 0108, 0301, and 0305), new roads would be minimized in RHCAs. The Proposed Federal Action would construct about 0.8 miles of new specified road in RHCAs – all in non-bull trout watersheds. The new specified roads would be located to avoid hydrologic flow paths to the degree possible. Temporary roads would not be built in RHCAs throughout the action area. In a few instances where road prisms already exist in RHCAs (e.g. undetermined roads), and there are culverts at the stream crossings, those prisms could be used as temporary roads as long as dirt is not side-casted within the RHCA. With these design features, temporary roads and TLM trails are unlikely to deliver sediment to streams.

RF-2f Avoid sidecasting of soils or snow. Sidecasting of road material is prohibited on road segments within or abutting RHCAs in priority watersheds.

The Proposed Federal Action would be consistent with INFISH standard RF-2f. The following design features would apply to the project:

- *There will be no side-casting of soils on any roads or trails that are located within RHCAs in the Nez Perce (HUC 0204), Little West Fork (HUC 0203), or Blue Joint Creek (HUC 0106) watersheds. All new road and trail segments within RHCAs must employ full bench construction with no side-casting.*

- *Side-casting of road material (during road grading and snowplowing) into streams, wetlands, and RHCAs is prohibited (SMZ Rule #8).*

- *Road maintenance activities (including snowplowing and dust abatement) will follow the minimization measures for each road activity type specified in the April, 2015 Road-Related Activities Biological Opinion (USFWS, 2015b).*

Adherence to these design features would ensure compliance with INFISH standard RF-2f.

RF-3a Determine the influence of each road on the Riparian Management Objectives. Meet the Riparian Management Objectives and avoid adverse effects on inland native fish by reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards or that have been shown to be less effective than designing for controlling sediment delivery, or that retard attainment of RMOs, or do not protect priority watershed from increased sedimentation.

The Proposed Federal Action would be consistent with INFISH standard RF-3a. The roads that apply to this standard are the segments that closely encroach on streams. For log hauling, those near-stream road segments are FRs 362 (Blue Joint Creek), 468 (Nez Perce Fork), 732 (Two Creek), 5637 (Flat Creek), and 5644 (Tough Creek). Those near-stream haul road segments would be graveled and BMP upgraded (some segments such as FRs 362 and 468 are already graveled) before log hauling occurs on their surfaces. There are other near-stream road segments in the action area that are proposed for decommissioning (recontouring) or storage and are unlikely to be used for hauling. These include FRs 91E (Ditch Creek) and the upper portion of 361 (Beavertail Creek). FR 13462 (Rombo Creek) would be stored after being used for hauling. All of these actions would help to meet INFISH standard RF-3a.

RF-3b Determine the influence of each road on the Riparian Management Objectives. Meet the Riparian Management Objectives and avoid adverse effects on inland native fish by prioritizing reconstruction based on the current and potential damage to inland native fish and their priority watersheds the ecological value of the riparian resources affected, and the feasibility of options such as helicopter logging and road relocation out of RHCAs.

The Proposed Federal Action would be consistent with INFISH standard RF-3b. See the previous response for INFISH standard RF-3b.

RF-3c Determine the influence of each road on the Riparian Management Objectives. Meet the Riparian Management Objectives and avoid adverse effects on inland native fish by closing and stabilizing or obliterating and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to inland native fish in priority watersheds, and the ecological value of the riparian resources affected.

The Proposed Federal Action would be consistent with INFISH standard RF-3c. See the previous response for INFISH standard RF-3a. A Forest fish biologist and hydrologist were on the interdisciplinary team that reviewed every road in the action area using the Roads Analysis process. How each road affected the RMOs was considered in the Roads Analysis, and was a factor in deciding whether to retain the road, decommission the road, or place the road into long-term storage. Road segments in RHCAs were given priority for decommissioning wherever possible.

RF-4 Construct new, and improve existing culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those improvements would/do pose a substantial risk to riparian conditions. Substantial risk improvements include those that do not meet design and operation maintenance criteria, or that have been shown to be less effective than designing for controlling erosion, or that retard attainment of RMOs, or that do not protect priority watersheds from increased sedimentation. Base priority for upgrading on risks in priority watersheds and the ecological value of the riparian resources affected. Construct and maintain crossings to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

The Proposed Federal Action would be consistent with INFISH standard RF-4. There would be no new road crossings on fish-bearing streams. If any new culverts installed on non-fish bearing streams are suspected of posing a substantial risk to riparian conditions, those culverts would be sized to accommodate the 100-year flood, including passing bedload and debris. On new culvert crossings that pose a low risk to riparian conditions, Forest engineers would be allowed to design and size the culverts as they see fit. Sizing for the 100-year flood would be overkill and unnecessarily costly.

RF-5 Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.

INFISH standard RF-5 is not applicable because the Proposed Federal Action would not build or replace any culverts on fish-bearing streams. There are several fish barrier culverts in the action area, but these culverts already have prior NEPA decisions that authorize their replacement or removal. The Forest will continue to implement those replacements/removals as funding allows.

RM-1 Design, construct, and operate recreation facilities, including trails and dispersed sites, in a manner that does not retard or prevent attainment of the RMOs and avoids adverse effects on inland native fish. Complete watershed analysis prior to construction of new recreation facilities in RHCAs within priority watersheds. For existing recreation facilities inside RHCAs, assure that the facilities or use of the facilities would not prevent attainment of RMOs or adversely affect inland native fish. Relocate or close recreation facilities where RMOs cannot be met or adverse effects on inland native fish cannot be avoided.

The Proposed Federal Action would be consistent with INFISH standard RM-1. The only new recreation facilities that would be constructed in the project would be short sections of motorized trails that connect existing roads. None of these trail segments would be located in RHCAs. Existing dispersed campsites along the West Fork Bitterroot River and Blue Joint Creek that are having adverse effects on RMOs would either be closed or modified to reduce their effects on riparian resources.

RM-2 Adjust dispersed and developed recreation practices that retard or prevent attainment of RMOs or adversely affect inland native fish. Where adjustment measures such as education, use limitations, traffic control devices, increased maintenance, relocation of facilities, and/or specific site closures are not effective in meeting RMOs and avoiding adverse effects on inland native fish, eliminate the practice or occupancy.

The Proposed Federal Action would be consistent with INFISH standard RM-2. Existing dispersed campsites along the West Fork Bitterroot River and Blue Joint Creek that are having adverse effects on RMOs would either be closed or modified to reduce their effects on riparian resources.

FM-1 Design fuel treatment and fire suppression strategies, practices, and actions so as not to prevent attainment of Riparian Management Objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem function or inland native fish.

The Proposed Federal Action would be consistent with INFISH standard FM-1. All of the fuel treatments that occur in the project must follow the mitigation measures in the U.S. Fish and Wildlife Service's programmatic biological assessment for prescribed fire (USFWS, 2001). Those mitigations have been incorporated into the project design features (Appendix B). They are designed to recognize fire's role in ecosystem function and minimize disturbance to riparian ground cover and vegetation. The effect on the Riparian Management Objectives is likely to be neutral in most places and possibly slightly positive in a few places.

FM-4 Design prescribed burn projects and prescriptions to contribute to the attainment of the Riparian Management Objectives.

The Proposed Federal Action would be consistent with INFISH standard FM-4. Same response as for FM-1 above.

RA-2 Trees may be felled in RHCAs where they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives.

The Proposed Federal Action would be consistent with INFISH standard RA-2. The following design feature would apply to the project:

- *In RHCAs, trees can be felled when they pose a safety risk. Felled hazard trees will be left on-site unless their removal is deemed necessary for safety reasons by the Timber Sale Administrator (TSA). If a felled safety tree in an RHCA falls across a road, the portion of the felled tree blocking the road will be cut up and rolled/thrown into the nearby RHCA. All portions of the felled tree not blocking the road will be left on site.*

Adherence to this design feature would ensure consistency with INFISH standard RA-2.

RA-3 Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of RMOs and avoids adverse effects on inland native fish.

The Proposed Federal Action would be consistent with INFISH standard RA-3. The following design features would apply to the project:

- *Prior to any applications, aquatic specialists will complete and document toxicity calculations that show that the active ingredient applied will be of a LOWER CONCENTRATION than the 96-hour LC_{50} value divided by 25 ($LC_{50}/25$) found in the literature for either rainbow trout or cutthroat trout, whichever is lowest. The $LC_{50}/25$ is known as the "maximum acceptable toxicant concentration (MATC)". Toxicity will be calculated at the subwatershed scale (e.g. Beavertail Creek, Ditch Creek, Tough Creek, etc), NOT the HUC 12 scale.*
- *Herbicides will not be applied in RHCAs.*
- *Only ground-based methods (backpack sprayers and/or vehicle-mounted sprayers) will be used to apply herbicides.*
- *Herbicides will be applied according to label directions.*

Adherence to these design features would ensure consistency with INFISH standard RA-3.

RA-4 Prohibit storage of fuels and other toxicants within RHCAs. Prohibit refueling within RHCAs unless there are no other alternatives. Refueling sites within RHCAs must be approved by the Forest Service or Bureau of Land Management and have an approved spill containment plan.

The Proposed Federal Action would be consistent with INFISH standard RA-4. The following design feature would apply to the project:

- *Generally, there will be no fuel storage, mixing of fuels, or refueling equipment in RHCAs. If there are no alternatives, refueling in RHCAs may occur, but must be pre-approved by the fisheries biologist or hydrologist, and have an approved spill containment plan. Small pumps (for example, Mark III) and chainsaws can be refueled within the RHCA as long as proper spill containment actions are implemented.*

Adherence to this design feature would ensure consistency with INFISH standard RA-4.

RA-5 Locate water drafting sites to avoid adverse effects to inland native fish and instream flows, and in a manner that does not retard or prevent attainment of RMOs.

The Proposed Federal Action would be consistent with INFISH standard RA-5. The following design features would apply to the project:

- *If drafting from streams occurs, intake hoses will be fitted with a screen mesh equal to or smaller than 3/32 inch.*
- *Prior to entering the project area, equipment that has the potential to come into contact with water must be inspected, clean and dry. Do not transfer water, sediment, or vegetation when moving between drafting sites. Operators will be encouraged to clean and dry their drafting equipment when moving between water sources and before the equipment comes in contact with water.*

Adherence to these design features would ensure consistency with INFISH standard RA-5.

WR-1 Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species, and contributes to attainment of Riparian Management Objectives.

The Proposed Federal Action would be consistent with INFISH standard WR-1. The watershed restoration actions proposed in the project (i.e. primarily the road decommissioning and storage) are designed to promote long-term ecological integrity, enhance the native fishery, and contribute to the attainment of the Riparian Management Objectives.

To summarize, the conclusion of this section (7.0) is that the Proposed Federal Action would be consistent with the goals, objectives and standards of the Forest Plan as amended by INFISH.

8. Determination of Effects to Bull Trout, Bull Trout Critical Habitat, and Sensitive Species

8.1 Bull Trout

The determination of effect on bull trout was determined by using the dichotomous key for making ESA determination of effects (USFWS, 2017), and by referencing the USFWS (2014) table that outlines "specific terms, definitions, criteria and wording for use in section 7 consultation documents." Selected choices in the key are highlighted in YELLOW.

1. Are there any proposed/listed fish species and/or proposed/designated critical habitat in the project action area (all 6th level HUCs intercepted by the project boundary), or downstream from the action area that may be affected by the proposed action?

NO .....No Effect
YES (or unknown).....Go to 2

2. Will the proposed action(s) have any effect whatsoever (beneficial or adverse) on individuals of the species; designated or proposed critical habitat; seasonally or permanently occupied habitat; unoccupied habitat necessary for the species survival; OR are any baseline habitat conditions adverse, as indicated by a "functional at unacceptable risk" rating for any habitat indicators?

NO .....No Effect
YES…….May Affect, go to 3

3. Are all project effects entirely discountable or beneficial in both the short-term and long-term AND are not adverse or insignificant to any habitat indicators rated "functioning at unacceptable risk"?

NO .....May Affect, Likely to Adversely Affect
YES .....May Affect, Not Likely to Adversely Affect

The effect of the Proposed Federal Action is "**May Affect - Likely to Adversely Affect (LAA)**" bull trout.

The LAA determination was selected for four reasons:

1. Hauling as many as 2.000 log truck loads on the near-stream segments of FR 468 increases the risk of additional sediment delivery to SR critical habitat (Nez Perce local population). This habitat is already considered to be in adverse condition for the *Sediment* and *Substrate Embeddedness* indicators. Although the WEPP:Road model predicts that hauling with BMP upgrades would actually deliver less sediment to the SR critical habitat than the existing traffic load is currently delivering (Table 13), at the very least, the large volume of log truck traffic would increase the risk of additional delivery occurring over a duration of about three years.

2. The sediment delivery caused by removing the FR 13462 culvert on Rombo Creek would temporarily degrade bull trout rearing habitat in the first 200 m of stream below the crossing. Low numbers (likely < 5 fish) of juvenile or small resident bull trout that reside in the affected area may be forced to abandon those habitats and move further downstream to avoid harassment, intermittent pulses of turbidity, and reductions in rearing habitats and macroinvertebrate food supply due to sediment infill. This temporary abandonment of habitat may result in behavioral changes such as reduced feeding efficiency and growth rates, and increased physiological stress. All of these factors increase the likelihood of mortality.

2. There is potential for a short-term (1-3 spawning classes), negative cumulative effect to occur in the first 1,000 feet or so of Rombo Creek below the FR 13462 crossing. This is because of an overlap of three sediment sources (existing high levels of sediment + sediment from the FR 13462 culvert removal + any sediment delivered by log hauling) in bull trout spawning and rearing habitat. In that area, the overlap of sediment sources could reduce egg and juvenile survivorship in 1-3 spawning classes of bull trout. Bull trout are rare (< 20 fish) in the affected area, so the extent of negative short-term effects on the Rombo Creek population would be limited.

4. There are three FUR indicators in the baseline that are predicted to suffer "minor degrades" due to short-term sediment increases. These are *Sediment* and *Substrate Embeddedness* in the Nez Perce Fork in HUC 0204, and *Pool Frequency and* Quality in Rombo Creek in HUC 0301. The Nez Perce Fork contains SR critical habitat; Rombo Creek contains an isolated section of spawning and rearing habitat for bull trout, but it is not designated as critical habitat.

8.2 Bull Trout Critical Habitat

Federally authorized, funded, or implemented activities require consultation to ensure that they are not likely to destroy or adversely modify bull trout critical habitat. The 2010 Final Rule designating bull trout critical habitat was published in the Federal Register on October 18, 2010 (USFWS, 2010; 75 FR 63898). The Final Rule designated critical habitat in three streams in the action area: (1) the West Fork Bitterroot River; (2) the Nez Perce Fork; and (3) Blue Joint Creek. The West Fork Bitterroot River is designated as FMO critical habitat; the Nez Perce Fork and Blue Joint Creek are designated as SR critical habitat.

The 2010 Final Rule established nine primary constituent elements (PCEs). Each PCE and its corresponding habitat indicators from the U.S. Fish and Wildlife Service Matrix of Pathway Indicators

(USFWS, 1998a) are displayed below. The PCEs are highlighted in *italics*; the matrix indicators are underlined. A rationale explaining the relationship between the PCEs and indicators is provided.

***PCE 1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to* contribute to water quality and quantity and provide thermal refugia**.

For PCE 1, the relevant indicators in the baseline matrix (Table 17) are Sediment, Substrate Embeddedness, Drainage Network Increase, Road Density & Location, and Riparian Conservation Area.

Project activities would generally occur outside of areas that influence springs, seeps, groundwater sources, and subsurface water connectivity. These areas are usually incorporated within RHCA buffers and would be avoided through project design. The connectivity between subsurface water sources and critical habitat in the West Fork Bitterroot River (FMO), the Nez Perce Fork(SR), and Blue Joint Creek (SR) is likely to be unaffected by project activities.

PCE 2. Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

For PCE 2, the relevant indicators in the baseline matrix (Table 75) are Barriers and Temperature.

Project activities would not create physical, thermal, biological, or chemical barriers to bull trout movement. One existing barrier (the FR 13462 culvert on Rombo Creek) to bull trout movement would be eliminated in the action area, but it would only affect a small bull trout population (Rombo Creek) that is isolated from critical habitat. Project activities would maintain water temperatures in critical habitat. Because of project design, the risk of fuel spills/chemical contamination in critical habitat would be discountable. Effects on stream flows in critical habitat are expected to be too small to be measured or evaluated.

PCE 3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

For PCE 3, the relevant indicators in the baseline matrix (Table 17) are Sediment, Substrate Embeddedness, Nutrients, Temperature, and Riparian Conservation Area.

Any sediment delivered to the Nez Perce Fork during log hauling could result in small and localized reductions in benthic macroinvertebrate densities in SR critical habitat. These reductions are likely to occur when log hauling is active, and could wax and wane over a period of about three years before diminishing. The reductions in benthic macroinvertebrate populations are likely to be too small in scale, too spatially scattered, and too temporary in duration for us to be able to accurately measure and evaluate. Benthic macroinvertebrate populations are known to recover quickly from disturbances. The terrestrial insect food base is expected to remain at or near its existing condition because of the preservation of RHCAs.

Project activities would not alter stream temperatures in critical habitat, and are unlikely to alter nutrient inputs.

Adherence to the herbicide design features is expected to reasonably protect aquatic organisms, including macroinvertebrates. Certain individuals may still react to herbicide chemicals but the overall populations are considered safe as long as herbicide concentrations remain lower than MATC concentrations (Mayer and Ellersieck 1986). The MATC method is comparable to methods used in risk assessments conducted by the Forest Service and complies with directions outlined in Forest Service Manual FSM 2900 (2011).

PCE 4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

For PCE 4, the relevant indicators in the baseline matrix (Table 17) are Sediment, Substrate Embeddedness, Large Woody Debris, and Pool Frequency and Quality.

Large wood is the feature that creates and maintains habitat complexity in the action area. The activities in the Proposed Federal Action would not affect large wood; however, they may result in short-term increases in substrate embeddedness and corresponding reductions in juvenile bull trout interstitial rearing habitat in SR critical habitat in the Nez Perce Fork. Elsewhere, habitat complexity would be maintained in the FMO critical habitat in the West Fork Bitterroot River and the SR critical habitat in Blue Joint Creek.

PCE 5. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.

For PCE 5, the relevant indicator in the baseline matrix (Table 17) is Temperature.

Project activities are expected to maintain water temperatures in critical habitat.

PCE 6. In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year (YOY) and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in large substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

For PCE 6, the relevant indicators in the baseline matrix (Table 17) are Sediment and Substrate Embeddedness.

Log hauling on the near-stream segments of FR 468 increases the risk of sediment delivery to SR critical habitat in the Nez Perce Fork. This could potentially cause scattered increases in substrate embeddedness, reductions in interstitial hiding cover, and increases in pool tail fines for a period of about three years while hauling is active. The degree of sediment impacts would wax and wane over a period of about three years while hauling is active. There would be no hauling during winter, so periods of sediment flushing during spring runoff would alternate with periods of heavier hauling in summer and autumn. Elsewhere in the action area, insignificant amounts of sediment are likely to be delivered to the FMO critical habitat in the West Fork Bitterroot River and the SR critical habitat in Blue Joint Creek.

PCE 7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departures from a natural hydrograph.

For PCE 7, the relevant indicators in the baseline matrix (Table 17) are Change in Peak/Base Flows, Drainage Network Increase, Disturbance History, and Disturbance Regime.

Effects on the hydrograph are expected to be too small to measure in critical habitat. Because of the design features, particularly the limitation of keeping ECAs below 20% in all watersheds, timber harvest and prescribed burning is anticipated to have insignificant effects on watershed-scale processes such as stream discharge, snow distribution and the timing of snowmelt runoff, and stream channel stability and erosion.

PCE 8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

For PCE 8, the relevant indicators in the baseline matrix (Table 75) are Temperature, Sediment, and Substrate Embeddedness.

Reproduction, growth, and survival of low numbers of juvenile and young-of-the-year bull trout could be inhibited in the SR critical habitat in the Nez Perce Fork while log hauling is occurring. Periods of heavier hauling in summer and autumn would alternate with periods of rest in winter followed by high spring runoff and sediment flushing. Elsewhere in the action area, reproduction, growth, and survival of bull trout

is unlikely to be inhibited by water quality or quantity in the FMO critical habitat in the West Fork Bitterroot River and the SR critical habitat in Blue Joint Creek.

PCE 9. Sufficiently low levels of occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

There are no indicators in the baseline matrix (Table 17) that apply directly to PCE 9.

Brown trout are the dominant predatory salmonid in the action area portion of the West Fork Bitterroot River. Brook trout have largely replaced bull trout as the dominant charr species in the Nez Perce Fork, and are also a competitive threat to bull trout in the lower portions of the Blue Joint Creek and Little West Fork drainages. Brook trout heavily outnumber bull trout in the portion of the Nez Perce Fork where log hauling on near-stream road segments would occur, and brown trout are increasing in that area. Both brook and brown trout have a distinct competitive advantage over bull trout in sediment-impaired habitats. Therefore, any sediment increases that occur in the SR critical habitat in the Nez Perce Fork could help to create habitat conditions, at least temporarily, that give brook and brown trout an even greater advantage over bull trout.

To summarize, bull trout critical habitat is present in three streams in the action area. Those streams are the West Fork Bitterroot River (FMO), the Nez Perce Fork (SR), and Blue Joint Creek (SR).

The activities in the Proposed Federal Action are predicted to have no effect or insignificant effects on PCEs 1, 2, 5 and 7, and potentially short-term adverse effects (due to increased risk of sediment delivery during log hauling) on PCEs 3, 4, 6, 8 and 9 in the SR critical habitat in the Nez Perce Fork. For those reasons, the determination of effect for bull trout critical habitat is **"May Affect – Likely to Adversely Affect (LAA)"**.

8.3 Sensitive Species

Two aquatic species are designated as Sensitive in the action area: (1) westslope cutthroat trout and (2) western pearlshell mussel. The BE determination of effect for each species is summarized below.

Westslope Cutthroat Trout

The determination for westslope cutthroat trout is "**May Impact Individuals or Habitat, But Will Not Likely Result in a Trend Toward Federal Listing or Result in Reduced Viability for the Population or Species (MIIH)**".

Similar to bull trout, sediment is the issue of concern for westslope cutthroat trout (westslope) in the Proposed Federal Action. Project activities would have no effect on other westslope habitat components such as wood recruitment, water temperature, and habitat complexity. The protection afforded by RHCA buffers around all streams and wetlands would preserve those features. As for migration barriers, removing the culverts on the FR 13462 crossing of Rombo Creek and the FR 361 crossing of Beavertail Creek would eliminate two known passage barriers and reconnect the fragmented westslope populations in those two streams. It would also restore year-round access to about one mile of spawning and rearing habitat (0.7 miles in Rombo Creek; 0.3 miles in Beavertail Creek). The activities in the Proposed Federal Action would not create any new passage barriers or impediments for westslope.

Direct Effects

Direct effects to westslope and their habitat would be limited to the first 200 m of Rombo and Beavertail creeks below the FR 13462 (Rombo) and 361 (Beavertail) culverts. When those culverts are removed and the road crossings are recontoured, sediment delivered by the construction activities may force some westslope to temporarily abandon their habitats in those zones and move further downstream to avoid harassment, intermittent pulses of turbidity, and reductions in rearing habitats and macroinvertebrate food supply due to sediment infill.

Another direct effect of removing the FR 13462 and FR 361 culverts would be an immediate reduction in the fragmentation of the Rombo and Beavertail westslope populations, and increased access to 1.0 miles of historic spawning and rearing habitat (0.7 miles in Rombo + 0.3 miles in Beavertail). Also, additional

colder water refugia habitat would become accessible year-round, which is important in light of climate change.

Indirect Effects

Indirect effects caused by having to temporarily abandon rearing habitats below the FR 13462 (Rombo) and 361 (Beavertail) culvert removal sites are likely to include behavioral changes such as reduced feeding efficiency and growth rates, and increased physiological stress. These factors could increase the risk of mortality for a period ranging from several days to as long as one year. The most at-risk life stages would be young-of-the-year and juveniles.

Indirect effects to westslope and their habitat may also occur as a result of sediment delivered by log hauling. This would potentially affect portions of the Nez Perce Fork, Rombo Creek, Blue Joint Creek, Little West Fork, and portions of smaller tributaries such as Buck, Beavertail, Ditch, Line, Mud, Took, Sand, Magpie, Flat, Tough, Two, and Sentimental creeks. Log truck traffic increases erosion on the surfaces of the haul roads, which in turn increases the risk of sediment delivery at road stream crossings and along near-stream road segments. With proper application and maintenance of BMP's, the amount of sediment that hauling delivers into westslope habitat is predicted to be less than what the existing traffic load is currently delivering (Table 13). Because of the BMP's, the amount of sediment delivered by hauling is expected to be too small in quantity and widely dispersed in area to be able to detect and measure effects on westslope individuals and habitat.

In the Nez Perce Fork and Rombo Creek, hauling may deliver small amounts of sediment into westslope spawning and rearing habitats that are currently considered to be in adverse condition (FUR) for the *Sediment* and *Substrate Embeddedness* indicators. The two affected reaches would be: (1) the portion of the Nez Perce Fork between Two and Flat creeks; and (2) the portion of Rombo Creek above the Forest boundary. Westslope are common in the affected portions of the Nez Perce Fork (> 1,000 fish per mile) and Rombo Creek (> 700 fish per mile). Because the species is numerous and the BMP upgrades are predicted to reduce sediment delivery (during log hauling) as compared to the existing condition, it is unlikely that hauling would result in measurable changes to westslope individuals or habitats in the Nez Perce Fork and Rombo Creek. Over time, the BMP's should result in gradual improvements in the quality of westslope spawning and rearing habitats in the Nez Perce Fork and Rombo Creek. Graveling near-stream road segments and stream crossings would provide the longest duration benefits.

In the West Fork Bitterroot River, existing sediment levels are low (Figure 17), and no indirect effects are likely to occur to westslope individuals or habitats as a result of sediment delivery. With the exception of the Nez Perce Fork, the other tributaries that enter the river in the action area only account for a tiny fraction of the West Fork's annual discharge and sediment load. Therefore, any sediment that makes its way into the West Fork is expected to be too small and widely dispersed/diluted to have a measurable effect on westslope individuals, populations, or habitat.

Adherence to the design features for herbicide spraying is expected to keep active ingredient concentrations in streams at levels that are too small to detect, and too small to have measurable effects on westslope cutthroat trout. Herbicides would only be applied at concentrations that are calculated to be lower than the LC_{50} values documented in risk assessments for rainbow or cutthroat trout divided by 25. The LC_{50} is the concentration of herbicide that is lethal to 50 percent of the test organisms exposed to that concentration for 96 hours. The $LC_{50}/25$ is called the "maximum allowable toxicant concentration", or MATC. The U.S. Fish and Wildlife Service believes that if herbicide concentrations are equal to or less than the MATC, then all aquatic species will be reasonably protected; certain individuals may still react to the herbicide but the overall population is considered safe (Mayer and Ellersieck 1986). The MATC method is comparable to methods used in risk assessments conducted by the Forest Service and complies with directions outlined in Forest Service Manual FSM 2900 (2011).

Cumulative Effects

The sediment delivered by (1) removing culverts (FR 13462 in Rombo Creek and FR 361 in Beavertail Creek); (2) recontouring near-stream road segments along Ditch Creek (0.6 miles of FR 66E) and upper Beavertail Creek (1.1 miles of FR 361); and (3) log hauling would be delivered to portions of those streams where westslope spawning and rearing habitat is already impaired by high sediment (Figure 17). This overlap of sediment sources may result in the following cumulative effects.

In Rombo Creek, westslope spawning and rearing habitat is already impaired by high sediment, and any additional inputs that occur as a result of removing the FR 13462 culvert, and possibly from log hauling, would overlap in space and time with the existing high levels of sediment. The area of concern would be the first 1,000 feet or so of Rombo Creek immediately below the FR 13462 crossing. In that area, the overlap of existing high sediment levels plus increases produced by removing the FR 13462 culvert plus any small increases delivered by log hauling could reduce egg and juvenile survivorship in 1-3 spawning classes of westslope. Westslope are common (> 125 individuals) in the affected area and throughout the drainage (> 1,500 individuals), so significant population effects are unlikely to occur.

Starting about a year after the FR 13462 culvert has been removed, the quality of westslope spawning and rearing habitat in Rombo Creek should start to gradually improve as a result of the road decommissioning and storage treatments and the BMP upgrades. Particularly beneficial would be the storage of FR 13462. Removing the FR 13462 culvert would reconnect the portion of the westslope population that is currently isolated above the culvert, and for the westslope below the culvert, open up year-round access to 0.7 miles of historic spawning and rearing habitat. This would be beneficial to the health and persistence of the Rombo Creek westslope population in the long-term.

In upper Beavertail Creek below the FR 361 crossing, the combination of existing high levels of sediment, sediment delivered by removing the FR 361 culvert, and sediment delivered by recontouring 1.1 miles of FR 361 that closely parallels (within 50 feet) Beavertail Creek would overlap in space and time. The cumulative effect would be a degradation of westslope spawning and rearing habitats in the first mile or so of Beavertail Creek below the FR 361 crossing. This degradation of habitat could reduce egg and juvenile survivorship for 4-5 year classes. Once sufficient vegetation has recovered on the recontoured prism of FR 361 (this usually takes about three years), the quality of westslope spawning and rearing habitats should start to gradually improve as a result of reduced delivery of road sediment. Similar to the situation in Rombo Creek, removing the FR 361 culvert would reconnect an isolated fragment of the westslope population and allow year-round access to 0.3 miles of historic spawning and rearing habitat – both would be beneficial to the westslope population in Beavertail Creek.

The lower 0.6 miles of Ditch Creek is an intermittent stream reach that provides a limited amount of rearing habitat for low numbers of juvenile and young-of-the-year westslope during the wetter periods of the year when sufficient water is present. The reach also contains high sediment levels (Figure 17). The sediment increases that would occur as a result of recontouring 0.6 miles of FR 66E that closely parallels the reach would overlap in space and time with the existing high sediment. The cumulative effect would be a degradation of westslope rearing habitats which could reduce juvenile survivorship for 3-4 year classes. Once sufficient vegetation has recovered on the recontoured prism of FR 66E (this usually takes about three years), the quality of westslope rearing habitats should start to gradually improve as a result of reduced delivery of road sediment.

The herbicide applications that occur as part of the Proposed Federal Action could overlap in time (but not spatially) with future herbicides applied by Ravalli County along the West Fork Highway, any known applications on private lands, and future roadside applications on Forest Service lands. The authorized roads in the Mud Creek project area (22 roads) were last sprayed in summers 2018 and 2019 and are not scheduled to be sprayed again until 2022 and 2023. The highway ditches were last sprayed by Ravalli County in summer 2020 and are scheduled to be sprayed again in 2022 or 2023. Spot spraying of patches of new invaders may occur during any summer. Future applications on private lands are unknown but are assumed to remain at or near current incidental use levels.

By design feature, all sources of herbicides (Ravalli County + any known private sources + Forest Service roadside spraying + the spraying in the Proposed Federal Action) must be combined in the calculations to determine how many acres can be sprayed per sub-watershed per year in the Proposed Federal Action to stay under the MATC level. Keeping cumulative active ingredient concentrations in streams under MATC levels is the key to this cumulative effects analysis. As long as that is done, herbicide applications are expected to have insignificant cumulative effects on westslope cutthroat trout individuals and populations (Mayer and Ellersieck 1986).

Summary of Effects

Portions of three westslope cutthroat trout populations would be suppressed by short-term sediment increases caused by implementing the Proposed Federal Action. These include (1) Rombo Creek - removing the FR 13462 culvert and log hauling; (2) upper Beavertail Creek – removing the FR 361 culvert and recontouring 1.1 miles of FR 361; and (3) Ditch Creek – recontouring 0.6 miles of FR 66E.

With the exception of Ditch Creek, the westslope cutthroat trout populations that currently reside in those streams contain > 1,500 individuals and to the best of our knowledge, have been stable for at least the past two decades.

Viability

The Proposed Federal Action is expected to maintain the viability of the westslope populations in the action area. The species is common and widely distributed across the action area, and no effects would occur to westslope populations that occur outside of the action area. In the long-term, the Proposed Federal Action should improve habitat conditions for westslope by reducing the delivery of road sediment in all of the 6th level watersheds in the action area.

Western Pearlshell Mussel

The determination for western pearlshell mussel is **"May Impact Individuals or Habitat, But Will Not Likely Result in a Trend Toward Federal Listing or Result in Reduced Viability for the Population or Species (MIIH)**".

The eDNA data indicates that western pearlshell mussels are only present in the portion of the West Fork Bitterroot River below Painted Rocks Dam.

Direct Effects

None are expected to occur.

Indirect Effects

The amount of sediment that would be delivered into the West Fork Bitterroot River as a result of the Proposed Federal Action is expected to be too small to have detectable effects on mussels or their habitat.

Applying herbicides at concentrations that are lower than MATC values in tributary watersheds, coupled with the much larger amount of water that is present in the West Fork Bitterroot River, is expected to have no detectable effect on individual mussels or mussel populations in the West Fork. The much larger volume of water in the river would dilute the already immeasurably small concentrations potentially entering the river from tributaries by magnitudes, resulting in no detectable effects to mussels.

Cumulative Effects

The western pearlshell mussel habitat in the West Fork Bitterroot River currently contains low amounts of sediment (Figure 17). The combination of project-delivered sediment and sediment delivered from other past, present, and reasonably foreseeable activities is expected to have an insignificant effect on mussels and their habitat in the West Fork. No reduction in habitat or mortality of mussels is likely to occur.

Keeping cumulative active ingredient concentrations under MATC levels in the tributaries to the West Fork would result in insignificant cumulative effects on individual mussels and their population in the river. The much larger volume of water in the river would dilute the already immeasurably small concentrations potentially entering the river from tributaries by magnitudes, resulting in no detectable cumulative effects to mussels.

Viability

The Proposed Federal Action would maintain the viability of the western pearlshell mussel population in the action area. There would be no effects on mussel populations outside of the action area.

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Section 10 - Summary and Signature

The determination for bull trout is "**May Affect – Likely to Adversely Affect"**.

The determination for bull trout critical habitat is **"May Affect – Likely to Adversely Affect"**.

The determination for westslope cutthroat trout is **"May Impact Individuals or Habitat, But Will Not Likely Result in a Trend Toward Federal Listing or Result in Reduced Viability for the Population or Species**".

The determination for western pearlshell mussels is **"May Impact Individuals or Habitat, But Will Not Likely Result in a Trend Toward Federal Listing or Result in Reduced Viability for the Population or Species**".

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